OBLON
SPIVAK
MCCLELLAND
MAIER
&
NEUSTADT
P.C.

ATTORNEYS AT LAW

JAMES J. KULBASKI
(703) 413-3000
JKULBASKI@OBLON.COM

SURINDER SACHAR
(703) 413-3000
SSACHAR@OBLON.COM

Docket No.: 203223US-28

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

RE: Application Serial No.: 09/863,384
Applicants: Shingo YAMAGUCHI
Filing Date: May 24, 2001
For: METHOD AND SYSTEM FOR CONTROLLING ACCESS TO NETWORK RESOURCES BASED ON CONNECTION SECURITY
Group Art Unit: 2135
Examiner: HA, LEYNNA A.

SIR:

Attached hereto for filing are the following papers:

APPEAL BRIEF W/APPENDICES

Our check in the amount of **$0.00** is attached covering any required fees. In the event any variance exists between the amount enclosed and the Patent Office charges for filing the above-noted documents, including any fees required under 37 C.F.R 1.136 for any necessary Extension of Time to make the filing of the attached documents timely, please charge or credit the difference to our Deposit Account No. 15-0030. Further, if these papers are not considered timely filed, then a petition is hereby made under 37 C.F.R. 1.136 for the necessary extension of time. A duplicate copy of this sheet is enclosed.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.

James J. Kulbaski
Registration No. 34,648

Surinder Sachar
Registration No. 34,423

Customer Number
22850
(703) 413-3000 (phone)
(703) 413-2220 (fax)

DOCKET NO: 203223US-28

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF	:
SHINGO YAMAGUCHI	: EXAMINER: HA, LEYNNA A.
SERIAL NO: 09/863,384	:
FILED: MAY 24, 2001	: GROUP ART UNIT: 2135
FOR: METHOD AND SYSTEM FOR CONTROLLING ACCESS TO NETWORK RESOURCES BASED ON CONNECTION SECURITY	:

APPEAL BRIEF

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

SIR:

Applicants appeal the outstanding Rejection of January 23, 2007.

I. REAL PARTY IN INTEREST

The real party in interest in the present application is the assignee of the present application, Ricoh Co., Ltd., having a place of business at 3-6 Nakamagome 1-chome, Ohta-ku, Tokyo 143-8555, Japan.

II. RELATED APPEALS AND INTERFERENCES

Appellant, Appellant's legal representative, and the assignee are not aware of any prior and pending appeals, interferences, or judicial proceedings that may be related to, directly effect or be directed effected by, or having a bearing on the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 41-43, 45, 50-63, 65, and 70-80 are pending in this application. Each of those claims is rejected and is being appealed.

Claims 1-40, 44, 46-49, 64, and 66-69 were canceled during prosecution of the present application.

IIII. STATUS OF AMENDMENTS

No amendment was filed subsequent to the Rejection of January 23, 2007.

IV. SUMMARY OF CLAIMED SUBJECT MATTER

The present invention is directed to controlling the level of access to network resources, connected to a network, based on a level of security of a connection to the network.[1]

As shown in Figure 1A in the present specification as a non-limiting example, different computing devices 2, 6 can be connected to an intermediate device 10. The claimed invention has as an operation to control the access of those computing devices 2, 6 to resources on the network 12A based on how the computing devices 2, 6 connect to the intermediate device 10. With reference to Figure 2A in the present specification as a non-limiting example, if either of the computing devices 2, 6 connect to the intermediate device 10 through an encrypted connection, driver 54 is activated and a firewall setting for level 1 access is provided. In that case a high level of access to various network resources, including a file server, can be provided.[2] Alternatively, if no encryption is utilized for the connection

[1] Specification at paragraph [0001].
[2] Specification at page 6, lines 10-15, paragraph [0023].

between either of the computing devices 2, 6 and the intermediate device 10, the driver 56 is activated and a firewall setting for level 2 access is utilized. In that case a user may only have a limited access to resources, including the Internet and an email server, on the network.[3] In both cases the user has access to network resources, but that access is more restricted for the level access.

In such ways, in the claimed invention, a security level of a network connection between the computing device and the intermediate device can control the level of network resources available to the computing device.

Independent Claim 41

Claim 41 is directed to a method of controlling a network. In the method a computer network connection is established between a computing device and an intermediate device that has network resources connected thereto. See the intermediate device 10 shown for example in Figures 1A, 2A, 2B, and 3 in the present specification, or in a further embodiment the login server 30, or in a further embodiment the firewall device 140 shown in Figure 5, see also the present specification at paragraphs [0017], [0032], [0033].

Further, a level of security in the computer network connection is determined based on whether the computer network connection to connect the computing device to the intermediate device is encrypted, such that a first level of security is set when it is determined that the computer network connection is encrypted and a second level of security is set when it is determined that the computer network connection is not encrypted. See the intermediate device 10, and with reference to Figures 2A and 2B in the present specification see the Driver For Wireless LAN Card 54 (Encryption) and the Driver For Wireless LAN Card 56 (No Encryption), operating in conjunction with the Firewall Setting for Level 1 (62) and the Firewall Setting for Level 2 (64), and step 106 in Figure 4, and see also the present

[3] Specification at page 6, lines 15-26, paragraph [0023].

specification at paragraphs [0022]-[0023]. In alternate embodiments see also the login server 30 and firewall device 140, paragraphs [0032], [0033].

Further, a level of access of the computing device to the network resource is controlled using the level of security of the computer network connection that has been determined, such that the computing device is only allowed access to a first set of network resources, including a file server, based on the determined first level of security, and is not allowed access to the first set of network resources, but is allowed access to a second set of network resources, including access to the Internet and an e-mail server, based on a determined second level of security. See the intermediate device 10, and particularly the firewall device 58 in Figures 2A and 2B and step 108 in Figure 4 of the present specification, see also the present specification at paragraphs [0023] and [0024]. In an alternative embodiment see the login server 30 and the present specification at paragraph [0031]. As another alternative embodiment see the firewall device 140 in Figure 5 and the present specification at paragraphs [0033]-[0034].

Independent Claim 61

Claim 61 is directed to a system for controlling a network. In the system a computer network connection is established between a computing device and an intermediate device that has network resources connected thereto. The corresponding element to the "means for establishing a computer network" is the intermediate device 10 shown for example in Figures 1A, 2A, 2B, and 3 in the present specification, or in a further embodiment the login server 30, or in a further embodiment the firewall device 140 shown in Figure 5, see also the present specification at paragraphs [0017], [0032], [0033].

Further, a level of security in the computer network connection is determined based on whether the computer network connection to connect the computing device to the intermediate device is encrypted, such that a first level of security is set when it is determined

that the computer network connection is encrypted and a second level of security is set when it is determined that the computer network connection is not encrypted. The element corresponding to the "means for determining a level of security" is the intermediate device 10, and with reference to Figures 2A and 2B in the present specification see the Driver For Wireless LAN Card 54 (Encryption) and the Driver For Wireless LAN Card 56 (No Encryption), operating in conjunction with the Firewall Setting for Level 1 (62) and the Firewall Setting for Level 2 (64), and step 106 in Figure 4, and see also the present specification at paragraphs [0022]-[0023]. In alternate embodiments see also the login server 30 and firewall device 140, paragraphs [0032], [0033].

Further, a level of access of the computing device to the network resource is controlled using the level of security of the computer network connection that has been determined, such that the computing device is only allowed access to a first set of network resources, including a file server, based on the determined first level of security, and is not allowed access to the first set of network resources, but is allowed access to a second set of network resources, including access to the Internet and an e-mail server, based on a determined second level of security. With respect to the "means for controlling a level of access of the computing device" see the intermediate device 10, and particularly the firewall device 58 in Figures 2A and 2B and step 108 in Figure 4 of the present specification, see also the present specification at paragraphs [0023] and [0024]. In an alternative embodiment see the login server 30 and the present specification at paragraph [0031]. As another alternative embodiment see the firewall device 140 in Figure 5 and the present specification at paragraphs [0033]-[0034].

V. GROUNDS OF REJECTION

Claims 41-43, 45, 50-63, 67, and 70-80 were rejected under 35 U.S.C. § 103(a) as unpatentable over U.S. patent 6,732,176 to Stewart et al. (herein "Stewart") and further in view of U.S. patent 6,453,159 to Lewis.

The above-noted rejection is appealed.

VI. ARGUMENT

Applicants respectfully submit the claims as currently written clearly recite features that are not taught or suggested by the applied art, and that have not been properly considered in the Office Action.

Independent claim 41 recites determining the level of security of the computer network connection based on whether the computer network connection is encrypted, and "wherein a first level of security is set when it is determined that the computer network connection is encrypted and a second level of security is set when it is determined that the computer network connection is not encrypted". Independent claim 41 also recites that a level of access of the computing device to the network resources is controlled such that the computing device is only allowed access to the first set of network resources, which include a file server, when the first level of security, i.e. an encrypted connection, is determined, and is not allowed access to the first set of network resources but is allowed access to the second set of network resources, which include access to the Internet and an email server, when a second level of security, i.e. a non-encrypted connection, is determined. Independent claim 61 also recites similar limitations.

Applicants respectfully submit neither of the applied art to Stewart nor Lewis teach or suggest the above-noted features of the claimed invention. That is, the features of the claimed invention noted above and reflected in the claims are that based on whether a device

connects to a computer network via an encrypted or not encrypted connection is determined and a level of access to the network is based on whether the encrypted or not-encrypted connection is made. That feature in the claims is not disclosed or suggested in either Stewart nor Lewis, and would not have been realized by even combining the teachings of Stewart and Lewis.

Stewart is directed to a system for providing access and/or roaming features on a network. In Figure 1 Stewart discloses different access points 120 accessing a network 130, to thereby access network providers 160. Stewart discloses allowing different access levels within a network, and to realize that operation Stewart discloses a management information base (MIB) 150 connected to the network that can store access information including access level or privilege level information.[4]

However, Stewart differs from the claims as written as Stewart does not control a level of access to a network ***based on whether an encrypted or not-encrypted connection is made to the network***. That is, in the claimed invention whether an encrypted or non-encrypted connection is made to the network is used to determine a level of access to the network. The outstanding Office Action does not appear to be properly considering that feature. That feature also clearly distinguishes over Stewart. To that extent the outstanding Office Action recognizes:

> However, Stewart did not further discuss the computer network connection to connect the computing device to the intermediate device is encrypted, wherein the first level of security is set when it is determined that the computer network connection is encrypted and a second level of security is set when it is determined that the computer network connection is not encrypted.[5]

[4] Stewart at column 7, lines 24-36.
[5] Office Action of January 23, 2007, middle of page 5.

To overcome that deficiency in Stewart the outstanding Office Action cites Lewis. However, even combining the teachings of Lewis and Stewart does not meet the claim limitations. That is the case because Lewis also does not disclose or suggest setting a level of access to a network based on whether an encrypted or a not-encrypted connection is made to the network. Absent such a teaching in Lewis no combination of teachings in Lewis and Stewart would meet such a claim feature.

In further detail, Lewis discloses a multilevel encryption scheme in which a first level of encryption is provided primarily for wireless communication taking place between a mobile terminal and an access point and a second higher level of encryption is provided that is distributed beyond the wireless communications onto a system backbone itself.[6]

The system of Lewis operates to introduce a key distribution server that operates in tandem with access points 54 to provide a second, higher level of encryption than a normal level of encryption.[7] Lewis also discloses that the key distribution server 76 includes a system device table 152 including a list of devices that can indicate devices authorized to communicate with the network 51 in either an encrypted or a non-encrypted format.[8] Lewis indicates that if the system receives a non-encrypted message from an access point 54, and if it is determined that the access point 54 is included in a table indicating it is authorized, the access point 54 may be permitted to communicate in a non-secure manner.[9]

Lewis thus discloses a device in which access to a network can be made by a non-encrypted message if that access point has previously been registered in a table as acceptable to communicate with a non-encrypted message.

If the teachings in Lewis were combined with the teachings in Stewart that would result in a system in which both encrypted and non-encrypted messages could be received at

[6] Lewis at column 2, lines 41-47.
[7] Lewis at Figure 1 and at column 5, line 36 et seq.
[8] Lewis at column 9, lines 59-64.
[9] Lewis at column 13, lines 17-25.

a network and the non-encrypted messages would be acceptable if the access point sending such non-encrypted messages was previously registered as authorized to communicate. That combination of teachings does not correspond to the claimed features. That is, even with such a combination of teachings the claimed features are not met.

The claims are not directed to a system that pre-registers which access points are allowed to communicate in a non-encrypted or encrypted manner. The claims take a different approach to allow a network access.

In the claimed invention, in the terminology of Lewis, if an access point had a non-encrypted connection to the network, a determination would be made that the non-encrypted connection was made, and the level of resources available on the network to the access point communicating with the non-encrypted message would be limited. If that ***same access point*** made a connection to the network with an encrypted communication, in the claimed invention that ***same access point*** would have greater access to resources on the network.

Thereby, in the claimed invention the actual access point is not the relevant factor as to the level of access on a network. Instead, the relevant factor is whether that same access point makes an encrypted or non-encrypted connection to the network.

Stated in another way, in the claimed invention the factor that determines a level of access on a network is whether an access point is making an encrypted or non-encrypted connection to the network. In Lewis, in contrast to the claimed invention, the determining factor to determine a level of access to a network is whether the access point is registered in a memory as having a certain access level. Lewis does not base a level of access to a network on whether a non-encrypted or encrypted connection is made, but instead bases access on stored information of a network access or privilege level for different access points.

Thereby, if the teachings in Lewis were combined with the teachings in Stewart that would result in a system that allows access to different levels of a network based on pre-

stored information about the different access elements. Such a system differs from the claims that recite determining a level of access based on whether an encrypted or non-encrypted connection is made to the network.

In such ways, neither Lewis nor Stewart teach the above-noted claim feature of "determining a level of security of the computer network based on determining whether the computer network connection to connect the computing device to the intermediate device is encrypted".

Thereby, the claims clearly distinguish over Stewart in view of Lewis.

VII. CONCLUSION

In view of the foregoing comments applicants respectfully submit the outstanding rejection must be REVERSED.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.

James J. Kulbaski
Attorney of Record
Registration No. 34,648

Surinder Sachar
Registration No. 34,423

Customer Number
22850

Tel: (703) 413-3000
Fax: (703) 413 -2220
(OSMMN 03/06)

I:\ATTY\SNS\20's\203223\203223US-AB2.DOC

APPENDIX

Claims 1-40 (Canceled).

Claim 41: A method of controlling a network, comprising:

establishing a computer network connection between a computing device and an intermediate device that has network resources connected thereto;

determining a level of security of the computer network connection based on determining whether the computer network connection to connect the computing device to the intermediate device is encrypted, wherein a first level of security is set when it is determined that the computer network connection is encrypted and a second level of security is set when it is determined that the computer network connection is not encrypted; and

controlling a level of access of the computing device to the network resources using the level of security of the computer network connection that has been determined, such that the computing device is allowed access to a first set of network resources, including a file server, based on a determined first level of security, and is not allowed access to the first set of network resources but is allowed access to a second set of network resources, including access to the Internet and an email server, based on a determined second level of security.

Claim 42: A method according to claim 41, wherein said establishing comprises:

establishing a wireless computer network connection.

Claim 43: A method according to claim 41, wherein said establishing the wireless computer network connection comprises:

establishing a wireless computer network connection which conforms to an IEEE 802.11b standard.

Claim 44 (Canceled).

Claim 45: A method according to claim 44, wherein said determining whether the computer network connection is encrypted comprises:

determining whether the computer network connection is encrypted using Wired Equivalent Privacy ("WEP") encryption.

Claims 46-49 (Canceled).

Claim 50: A method according to claim 41, wherein:

said determining is performed by the intermediate device, and

said controlling is performed by the intermediate device.

Claim 51: A method according to claim 50, wherein:

said determining is performed by the intermediate device which is a router.

Claim 52: A method according to claim 51, wherein:

said controlling is performed by the intermediate device which is a router having a firewall operation.

Claim 53: A method according to claim 52, wherein:

said establishing is performed using the intermediate device which is a router which establishes a wireless connection to the computer.

Claim 54: A method according to claim 41, wherein:

said determining is performed by a server running a network operating system, the server being different from the intermediate device, and

said controlling is performed by the server running the network operating system.

Claim 55: A method according to claim 54, wherein:

said determining is performed by the server which is running a network directory service.

Claim 56: A method according to claim 54, wherein:

said establishing is performed by a bridge connected to the computer through the computer network connection.

Claim 57: A method according to claim 56, wherein:

said establishing is performed by the bridge connected to the computing device through the computer network connection which is a wireless network connection.

Claim 58: A method according to claim 41, wherein said controlling comprises:

controlling the level of access by a stand-alone firewall device which is connected between the intermediate device and the network resources.

Claim 59: A method according to claim 58, wherein said determining comprises:

determining the level of security using the intermediate device.

Claim 60: A method according to claim 58, wherein said establishing comprises:

establishing the computer network connection as a wireless connection using the intermediate device.

Claim 61: A system for controlling a network, comprising:

means for establishing a computer network connection between a computing device and an intermediate device that has network resources connected thereto;

means for determining a level of security of the computer network connection based on determining whether the computer network connection to connect the computing device to the intermediate device is encrypted, wherein a first level of security is set when it is determined that the computer network connection is encrypted and a second level of security is set when it is determined that the computer network connection is not encrypted; and

means for controlling a level of access of the computing device to the network resources using the level of security of the computer network connection that has been determined, such that the computing device is only allowed access to a first set of network resources, including a file server, based on a determined first level of security, and is not allowed access to the first set of network resources but is allowed to access to a second set of network resources, including access to the Internet and an email server, based on a determined second level of security.

Claim 62: A system according to claim 61, wherein said means for establishing comprises: means for establishing a wireless computer network connection.

Claim 63: A system according to claim 61, wherein said means for establishing the wireless computer network connection comprises:

means for establishing a wireless computer network connection which conforms to an IEEE 802.11b standard.

Claim 64 (Canceled).

Claim 65: A system according to claim 64, wherein said means for determining whether data from the computing device is encrypted comprises:

means for determining whether the computer network connection is encrypted using Wired Equivalent Privacy ("WEP") encryption.

Claims 66-69 (Canceled).

Claim 70: A system according to claim 61, wherein:

said means for determining is the intermediate device, and

said means for controlling is the intermediate device.

Claim 71: A system according to claim 70, wherein:

said means for determining is the intermediate device which is a router.

Claim 72: A system according to claim 71, wherein:

said means for controlling is the intermediate device which is a router having a firewall operation.

Claim 73: A system according to claim 72, wherein:

said means for establishing is the intermediate device which is a router which establishes a wireless connection to the computer.

Claim 74: A system according to claim 71, wherein:

said means for determining is a server running a network operating system, the server being different from the intermediate device, and

said means for controlling is the server running the network operating system.

Claim 75: A system according to claim 74, wherein:

said means for determining is the server which is running a network directory service.

Claim 76: A system according to claim 74, wherein:

said means for establishing is a bridge connected to the computer through the computer network connection.

Claim 77: A system according to claim 76, wherein:

said means for establishing is the bridge connected to the computer through the computer network connection which is a wireless network connection.

Claim 78: A system according to claim 61, wherein said means for controlling comprises:

a stand-alone firewall device which is connected between the intermediate device and the network resources.

Claim 79: A system according to claim 78, wherein said means for determining comprises:

means for determining the level of security using the intermediate device.

Claim 80: A system according to claim 78, wherein said means for establishing comprises:

means for establishing the computer network connection as a wireless connection using the intermediate device.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.

US006026910A

United States Patent [19]

Masterson et al.

[11] Patent Number: 6,026,910

[45] Date of Patent: Feb. 22, 2000

[54] **POWER TOOL AND VIBRATION ISOLATOR THEREFOR**

[75] Inventors: **Peter A. Masterson**, Rock Hill, S.C.; **William K. Wallace**, Barneveld, N.Y.; **Ulrich A. Kuester**, Erie, Pa.

[73] Assignees: **Chicago Pneumatic Tool Company**, Rock Hill, S.C.; **Lord Corporation**, Cary, N.C.

[21] Appl. No.: **09/006,098**

[22] Filed: **Jan. 13, 1998**

[51] **Int. Cl.**[7] **B27B 17/00**

[52] **U.S. Cl.** **173/162.2**; 173/169; 267/141.1; 267/153

[58] **Field of Search** 173/162.1, 162.2, 173/210, 169, 170, 211; 267/141.1, 141, 153, 137

[56] **References Cited**

U.S. PATENT DOCUMENTS

1,592,130	7/1926	Wadsworth .	
2,058,583	10/1936	Forss .	
3,003,738	10/1961	Horovitz	267/141.1
3,477,674	11/1969	Schaller	267/153
3,571,874	3/1971	Von Arx .	
3,652,074	3/1972	Frederickson et al.	173/162.1
3,700,015	10/1972	Kobayashi et al.	267/137
3,845,827	11/1974	Schulin	173/162.1
3,968,843	7/1976	Shotwell .	
4,135,301	1/1979	Hoeppner	267/137
4,522,270	6/1985	Kishi .	
4,995,598	2/1991	Ingham	267/141.1
5,054,414	10/1991	Yamaguchi .	
5,368,107	11/1994	Taomo .	
5,447,295	9/1995	Taomo .	
5,453,577	9/1995	Everett et al. .	
5,551,661	9/1996	Bunker	267/153

FOREIGN PATENT DOCUMENTS

0 164 324	12/1985	European Pat. Off. .
716805	of 1980	Russian Federation .
WO 94/16864	of 1994	WIPO .
WO 97 25186	7/1997	WIPO .

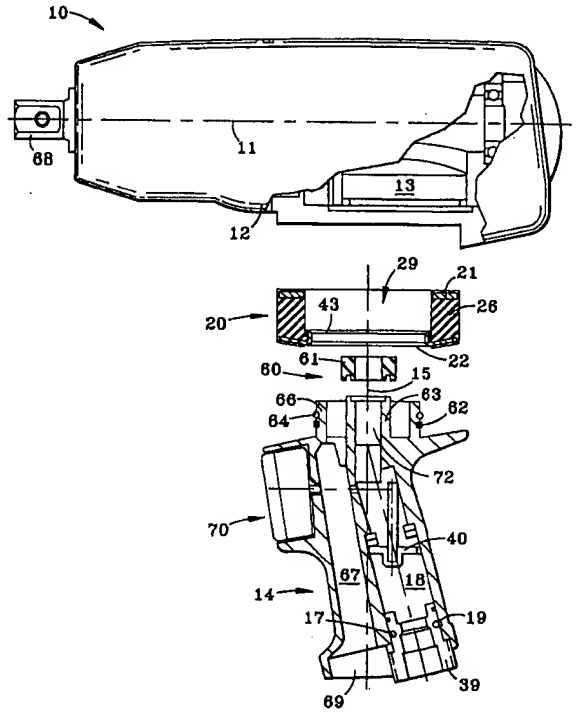
Primary Examiner—Scott A. Smith

Attorney, Agent, or Firm—Schmeiser, Olsen & Watts

[57] **ABSTRACT**

The present invention relates to a power tool having a housing, a handle having an inlet passage and an outlet passage extending therethrough, and a pneumatic pressure seal/vibration isolator positioned between the handle. The present invention provides a tool that has an excellent handle to housing seal and does not exhibit heavy vibrations. The present invention is also the vibration isolator that seals the handle to the motor housing and reduces vibrational transmissions to a user. Also disclosed is a power tool having a vibration isolator coupled to the housing and handle, and a mechanism for allowing sliding rotation of the handle relative to the vibration isolator, thereby allowing the handle to point in a different direction other than toward the point of impact. The present invention also discloses a pneumatic power tool including a handle, a housing having a first longitudinal axis, and a vibration isolator rotatably coupling the handle to the housing, the vibration isolator including a central opening through which air passes that is not aligned with the first longitudinal axis.

12 Claims, 3 Drawing Sheets



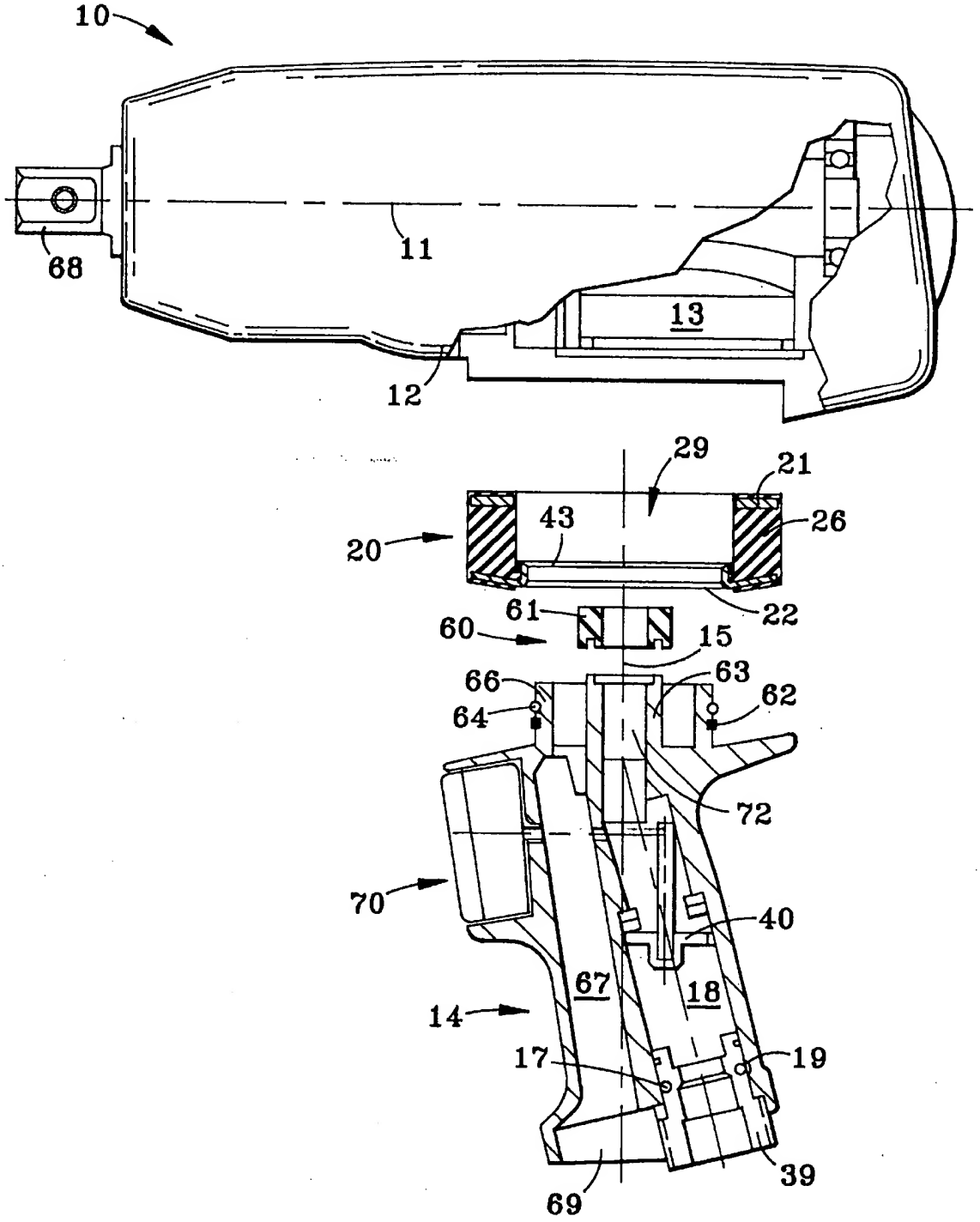

10
68
11
13
12
29
21
43
26
20
22
61
60
15
66
63
62
64
72
70
40
67
18
14
17
19
39
69

FIG. 1

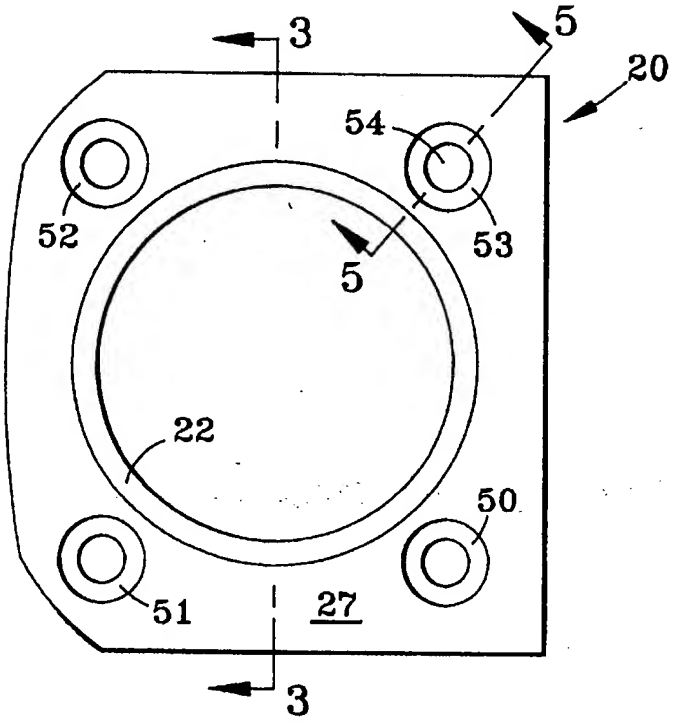


FIG. 2

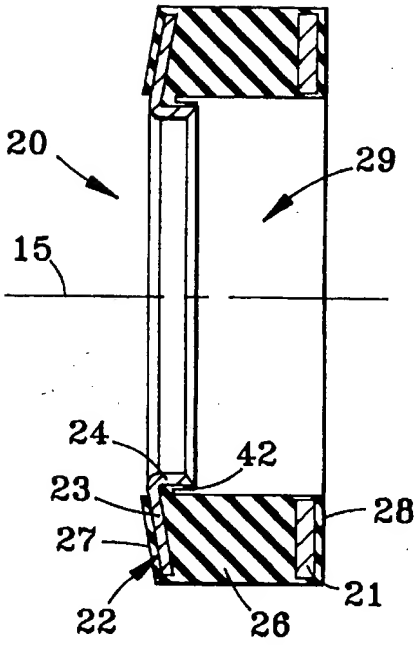


FIG. 3

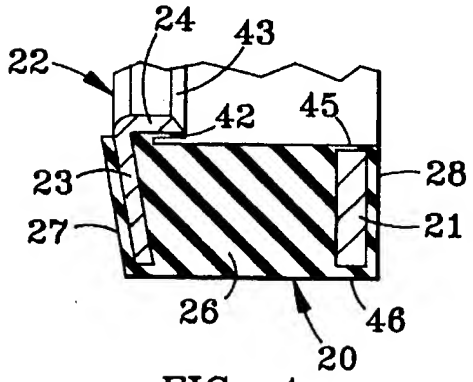


FIG. 4

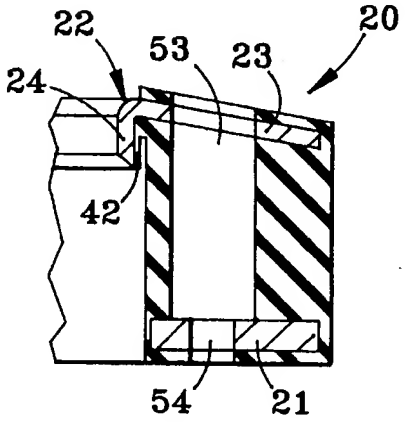


FIG. 5

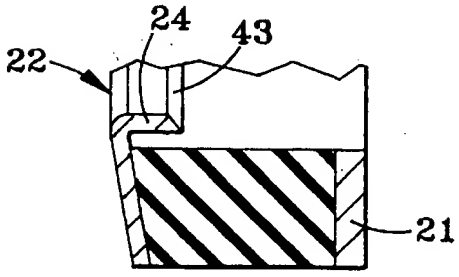


FIG. 6

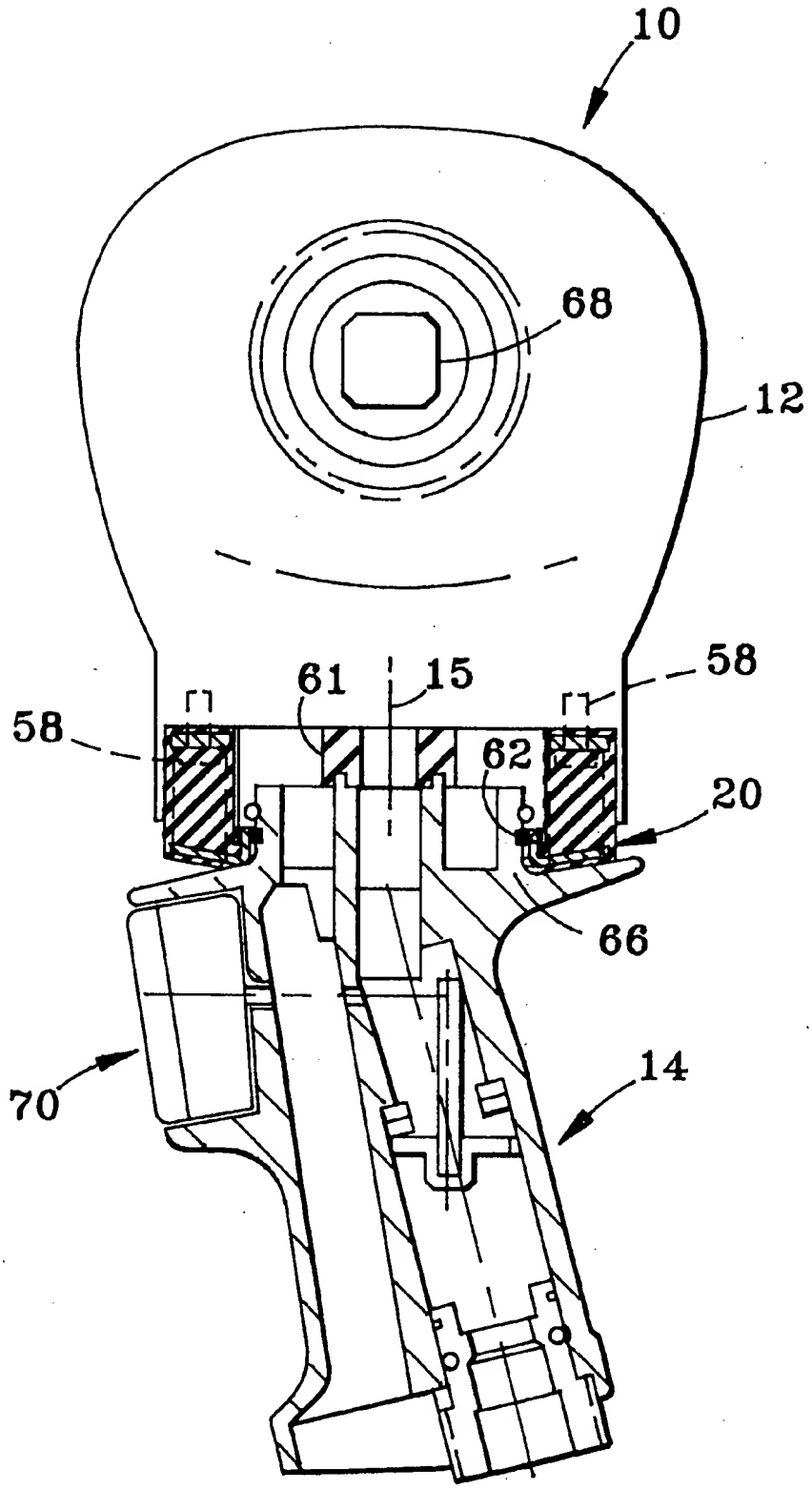


FIG. 7

POWER TOOL AND VIBRATION ISOLATOR THEREFOR

FIELD OF THE INVENTION

The present invention relates generally to hand-held power tools. In particular, the present invention is concerned with power tools with a vibration isolator. Further, the present invention relates to the vibrator isolator.

BACKGROUND OF THE INVENTION

A recurring difficulty with hand-held power tools is a lack of an easily mounted vibrational isolator between the tool motor housing and the tool handle. Vibrations being transmitted to a tool handle can cause discomfort to certain user's. Another hurdle in the related art is pneumatically sealing the power tool handle to the motor housing where the handle delivers compressed air and exhausts expanded air to and from the motor housing. Yet another difficulty arises in arriving at tool handles that provide a convenient and comfortable hand/wrist position for a user.

Manufacturers and developers have created a number of vibration isolators to prevent vibration transmission to a user. For example, U.S. Pat. No. 2,058,583 to Forss, illustrates a vibration isolator **16** for isolating the handle **9** from the motor housing **1**. U.S. Pat. No. 3,968,843 to Shotwell also provides a vibration isolator **30, 32, 34**. Further, WO 94/16864 to Gwinn discloses a vibration isolator **10** enclosed within a power tool housing. The vibration isolators discussed above require elaborate handle to housing fastener setups that prevent the provision of adjustable handles and are limited to isolators being in alignment with the housing.

With regard to sealing the handle to the housing, separate sealing structures are oftentimes required altogether. For instance, in U.S. Pat. No. 3,968,843 to Shotwell, a liner **40** separate from the isolator **30** is used to provide a sealed passage. The additional structure adds weight and complexity to the power tool. The related art also fails to sufficiently address the sealing of a handle where the handle both delivers and exhausts air to and from the motor housing.

With regard to adjustable handles, the related art has utilized straight, side, angled or spade handles in order to achieve a correct hand/wrist position. The difficulty with this concept is that the operator has to do a variety of different jobs with the same tool. Thus, a straight handled tool may be ideal for one application but not ideal on another application where a turned or angled handle is better suited.

In an attempt to overcome this limitation, power tool developers and manufacturers have introduced adjustable type handles for their power tools and varied vibration isolators. For example, U.S. Pat. No. 4,522,270 issued to Kishi discloses a hand-held power tool which provides a handle that pivots angularly with respect to the tool housing. Similarly, U.S. Pat. No. 3,571,874 issued to Von Arx discloses a descaling device which also has a handle that pivots angularly with respect to the tool housing. These inventions allow the tool handle to be angularly pivoted toward or away from the tool attachment/impact point. This gives the operator an increased ability to find a more comfortable or efficient handle position which he or she lacked in the past.

While the aforementioned patents provide a certain amount of improvement with regard to handle comfort, there are still difficulties which these devices do not address. For instance, given that most tools have a trigger on the handle, these devices do not have the ability to change the direction of the trigger with respect to the tool housing. In other words, the trigger always faces in the same direction—towards the tool attachment/impact point. Under certain circumstances, in order to achieve the ideal hand/wrist position, an operator may want to have the trigger facing a direction other than that of the direction of the tool. Further, the rotatable handle tools heretofore used do not provide sufficient vibration isolation between the motor housing and handle and, further, do not address the sealing of the handle to the motor housing where such sealing is necessary.

Accordingly, until now, there has been a long-felt need for a power tool having a structure that vibrationally isolates and seals a handle to a motor housing in a single, easily mounted structure where the handle delivers/exhausts air to the housing. Further, there has been a long-felt need for a structure that addresses the above noted problems and also allows for adjustment of the handle relative to the motor housing. The present invention seeks to provide this functionality.

SUMMARY OF THE INVENTION

In a first general aspect in accordance with the present invention is provided a power tool including a housing, a handle, rotatably attached to the housing, having an inlet passage and an outlet passage extending therethrough, and a pneumatic pressure seal/vibration isolator between the motor and handle. The pneumatic pressure seal/vibration isolator includes a first rigid member operatively coupled to the housing, a second rigid member operatively coupled to the handle, and an elastomeric element extending between the first rigid member and the second rigid member. This aspect allows pneumatic pressure to pass through the handle yet provides for excellent vibration isolation.

In a second aspect in accordance with the present invention is provided a vibration isolator having a first member operatively coupled to the motor housing, a second member operatively coupled to the handle, and an elastomeric member extending between the first member and second member. The second member also includes a first portion operatively coupled to the elastomeric member and a second portion extending toward the first member. This aspect allows for excellent vibration isolation between the handle and motor housing.

In a third general aspect of the present invention is provided a power tool including a motor housing, a handle mounted to the motor housing having a pilot extending therefrom, and a vibration isolating seal positioned between the motor housing and the handle. The vibration isolating seal also includes an opening to operatively couple to the pilot.

In a fourth general aspect of the present invention is included a power tool including: a device for housing a motor, a device for holding the tool, and a device for rotationally connecting and pneumatically sealing the device for holding to the device for housing and for vibrationally isolating the device for holding from the device for housing. The above two aspects provide mechanisms by which the handle is rotatably connected and sealed to the motor housing while also being vibrationally isolated from the motor housing.

In a fifth aspect in accordance with the present invention is provided a power tool including: a housing, a handle, a vibration isolator operatively coupled between the housing and the handle, and a device for allowing sliding rotation of the handle relative to the vibration isolator. The vibration isolator and the device for allowing sliding rotation provide

structure by which a power tool may have an adjustable handle while also vibrationally isolating the handle from the motor housing.

Lastly, in another general aspect of the present invention is furnished a pneumatic power tool comprising a handle, a housing having a longitudinal axis, and a vibration isolator rotatably coupling the handle to the housing, the vibration isolator including a central opening through which air passes, and wherein the central opening is in non-alignment with the longitudinal axis. This aspect provides a pneumatic tool with a vibration isolation but without the requirement that the isolator be located along the longitudinal axis of the housing.

The foregoing and other features and advantages of the present invention will be apparent from the following more particular description of the preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The preferred embodiments of this invention will be described in detail, with reference to the following figures, wherein like designations denote like elements, and wherein:

FIG. 1 is a side view of a power tool in accordance with a preferred embodiment of the present invention;

FIG. 2 is a plan view of a vibration isolator in accordance with a preferred embodiment of the present invention;

FIG. 3 is a cross-sectional view of the vibration isolator in accordance with a preferred embodiment of the present invention;

FIG. 4 is an exploded partial cross-sectional view of the vibration isolator in accordance with a preferred embodiment of the present invention;

FIG. 5 is an exploded partial cross-sectional view of the vibration isolator in accordance with a preferred embodiment of the present invention;

FIG. 6 is an exploded partial cross-sectional view of a vibration isolator in accordance with a second embodiment of the present invention; and

FIG. 7 is a partial cross-sectional view of a power tool in accordance with a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Although certain preferred embodiments of the present invention will be shown and described in detail, it should be understood that various changes and modifications may be made without departing form the scope of the appended claims. The scope of the present invention will in no way be limited to the number of constituting components, the materials thereof, the shapes thereof, the relative arrangement thereof, etc., and are disclosed simply as an example of the preferred embodiment.

Referring now to the drawings and more particularly to FIG. **1**, there is shown a side view of a hand-held power tool **10** with the handle **14** in the straight-ahead position. The power tool basically comprises a motor housing **12**, a handle **14** and a coupling system, and more particularly a vibration isolator **20** that also acts as a seal. The motor housing **12** extends along a longitudinal axis **11** and comprises a tool attachment area **68** at the forward end of the axis **11**, and a motor **13** at the rear end of the axis **11**. The handle extends generally perpendicularly from the motor housing **12** and includes an inlet bushing **39** at a lower end to attach a source of compressed air (not shown) to the handle. The handle **14** also includes an air intake passage **18** that provides compressed air to the motor housing **12** and an exhaust passage **67** to exhaust expanded air from the motor housing **12**.

The vibration isolator or vibration isolating seal **20** in accordance with the present invention is capable of the combined functions of coupling and sealing the motor housing **12** to the handle **14**, and vibrationally isolating the handle **14** from the motor housing **12**. As shown in FIGS. **2–5**, the vibration isolator **20** generally includes a first rigid member or element **21** and a second rigid member or element **22** that are connected by an elastomeric member **26**. The vibration isolator **20** also includes a central axis **15** and a central opening **29** through which air passes as will be described infra. The rigid members **21, 22** may be made from a variety of rigid materials such as steel, aluminum or alloys thereof. The elastomeric member or element **26** may be made from any elastomeric material, e.g., rubber or synthetic elastomer such as neoprene.

As more particularly illustrated in FIGS. **2** and **5**, the vibration isolator **20** includes a plurality of sets of apertures **50–53** for connection of the vibration isolator **20** to the motor housing **12**. Each set of apertures **50–53** includes an aperture in the first member **21**, the second member **22** and the elastomeric member **26**. The apertures in each member are aligned for insertion of a fastener **58** (shown only in FIG. **7**) therethrough and into the motor housing **12**. The first member **21** has an aperture **54**, as shown in FIG. **5**, that is slightly smaller than the apertures through the elastomeric member **26** and second member **22** to receive the head of the fastener **58**.

The second member **22** includes a first portion **23** and a second portion **24** which are bonded to the elastomeric member **26**. The second portion **24** extends from an edge of the first portion **23** towards the first member **21**. In a preferred embodiment of the present invention, the second portion **24** also includes a beveled edge **43**, the function of which will be described infra.

In the preferred embodiment of the present invention, as shown in FIGS. **3–5**, the elastomeric member **26** is formed so as to enclose at least a portion of the first and second members **21, 22** to aid in pneumatically sealing the handle **14** to the motor housing **12** so that compressed air and expanded air can be delivered to and from the motor housing **12**, respectively. In particular, the elastomeric member **26** includes a covering portion **27** that extends around the first portion **23** of the second member **22** and a thin lip **42** that runs along an interior surface of the second portion **24** of the second member **22**. Furthermore, the elastomeric member preferably encircles or covers the first member **21** in its entirety. More specifically, the elastomeric member **26** includes a pair of leaflets **45, 46** that extend over the edges of the first member **21**, and a covering layer **28** that covers the remaining edge of the first member **21**.

It should be noted, however, that the first and second members need not be enclosed by the elastomeric member **26**. As shown in FIG. **6**, the members **21, 22** may merely be bonded to the elastomeric member **26**. However, in this setting the members **21, 22** and the motor housing **12** must be more precisely machined so as to prevent leakage of compressed air and expanded air. Further, a gasket (not shown) may be required between member **21** and motor housing **12**. For example, the gasket could be incorporated into member **21** or an O-ring type feature or lip could be provided on the elastomeric member **26**.

Again referring to FIG. 1, the handle 14 is attached to the vibration isolator 20 by a flange or pilot 66. To connect the handle 14, the pilot 66 is inserted into the second portion 24 of the second member 22, which mates with the pilot 66. A clamp ring 64 is then inserted into the pilot 66 to prevent removal. Further, the pilot 66 includes an elastomeric o-ring 62 that seals the pilot 66 against the second portion 24 of the second member 22. The o-ring 62 can be made from any elastomeric material, for instance, rubber. To seal the air intake passages 18, 72 to the motor housing 12, an intake seal 61 is provided which seals an intake pilot or flange 63 on the handle 14 to the motor housing 12. The intake seal 61 can be made from any elastomeric material, e.g., rubber or synthetic elastomers such as neoprene. In combination, the seals 61 and 62 and flanges 63, 66 form a pair of concentric passages for intake and exhaust of air through the central opening 29 of the vibration isolator 20. As an alternative, it is also contemplated that the intake seal 61 could be incorporated into the elastomeric member 26.

In the preferred embodiment, the pilot 66 is cylindrical as is the first portion 24 of the second member 22. The clamp ring 64 is circular and is adapted to bear against the bevel 43 formed on the first portion 24 of the second member 22. This structure allows relatively frictionless sliding rotation of the handle 14 relative to the motor housing 12. As a result, the handle 14 can rotate about the central axis 15 independent of motor housing 12 to better accommodate the user's comfortable use of the tool 10.

The position to which the handle 14 is adjusted is preferably held by the back pressure of the elastomeric member 26 including covering layer 27, and the intake seal 61. The pressure, acting downwardly upon the handle 14, aids in pressing/holding the clamp ring 64 against bevel 43. It is also contemplated that a wavy spring (not shown) or similar structure be incorporated, for instance, along the top edge of the flange 66 for engagement with the motor housing 12 to position the handle 14. However, direct metal to metal structure is to be avoided as it would potentially short circuit, i.e., prevent proper operation of, the vibration isolator 20. Furthermore, if such structure were to be provided, the mechanism by which engagement with the motor housing 12 is created provide low friction in comparison to the torsional stiffness of the isolator 20 to avoid spring back of the handle 14 during adjustment.

In the preferred embodiment, the hand tool 10 is powered via compressed air. This is accomplished as follows. Air enters through inlet bushing 39 into intake passage 18, passes through the throttle valve 40, through passage 72, and to a reverse valve (not shown) in the motor housing 12. Air inlet bushing 39 may be secured to the tool handle 14 by means of a pin 17 and a groove 19. This permits the inlet to turn freely relative to the handle 14.

Air then passes to the motor housing and a valve system (not shown) in the motor housing 12, then through the motor 13 in a conventional fashion to operate in the power tool. Air can exhaust from the motor housing 12 through handle exhaust passage 67, then through diffuser 69, and into the atmosphere.

As shown in FIG. 1, the tool is depicted in its standard "straight-ahead" position. That is, the trigger 70 is pointed in the same direction as the tool attachment device 68 on the front of motor housing 12. This is the position that such tools are normally fixed for use. The tool attachment device 68 may comprise a square drive anvil, a chuck, or any other device which will allow for the attachment of sockets, wrenches, drill bits, or any other rotating attachment apparatus.

It should be recognized, however, that there are a number of advantages created by having the vibration isolator 20 and handle 14 in non-alignment with the longitudinal axis 11 of the motor housing 12. The advantages are realized in that the present invention allows for many more comfortable settings for a user. For instance, FIG. 7 depicts the tool 10 with the handle 14 rotated 90° about the central axis 15 and shows the vibration isolator 20 and handle 14 connected to the motor housing 12. Handle 14 is shown (along with trigger 70) facing in a leftward direction, while motor housing 12 (along with tool attachment device 68) is shown facing the forward direction. Thus, as depicted in this diagram, handle 14 and the tool housing 12 can be set to face in different directions. In particular, the handle 14 is fully rotatable (i.e., 360°) about the central axis 15 which allows for an unlimited number of handle positions. This allows the user to adjust the tool to obtain the correct wrist/hand position for the variety of jobs he or she may be doing while also vibrationally isolating the handle 14 from the motor housing 12.

It should also be acknowledged, as shown in FIGS. 1 and 7, that the base of the handle 14 may be constructed such that it is cocked in a slightly backward position and such that it rotates about the central axis 15 of the vibration isolator 20 which is perpendicular to the longitudinal axis 11 of the motor housing 12. This particular construction allows for more freedom in adjustment to better accommodate a user's comfort. However, it is possible to incorporate a system wherein the positioning of the handle 14 is provided in a different way. For instance, the handle 14 could rotate about an axis that is not perpendicular to the motor housing 12. In particular, the position in which vibration isolator 20 connects to handle 14 could be constructed skewed, or angularly offset, to allow for a skewed connection of the vibration isolator 20 to the motor housing 12. Similarly, the vibration isolator 20 may be attached to the motor housing 12 at a skewed or angularly offset position.

In the preferred embodiment, the motor housing 12 and the handle 14 are depicted as co-planar. However, it is envisioned that a system could be utilized in which the motor housing 12 and the handle 14 were not co-planar. Because of the design of the air intake and exhaust systems, along with the vibration isolating seal 20, compressed air would still reach the motor housing 12 through the handle 14 and exhaust out of the handle while the handle 14 is in any rotated position.

As depicted in the drawings, the tool motor 13 is driven by compressed air. However, it is envisioned that the vibration isolating seal and rotatable handle system could be used for any fluid-driven power tool. Further, the rotatable handle system and vibration isolator could also be used on tools powered by other sources, e.g., electricity.

While this invention has been described in conjunction with the specific embodiments outlined above, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art. Accordingly, the preferred embodiments of the invention as set forth above are intended to be illustrative, not limiting. Various changes may be made without departing from the spirit and scope of the invention as defined in the following claims.

We claim:

1. A vibration isolator for use on a power tool having a motor housing and a handle, the vibration isolator comprising:

a first member including at least one open passageway therethrough, and adapted to be coupled to the motor housing;

a second member including at least one open passageway therethrough, and adapted to be coupled to the handle;

an elastomeric member extending between the first member and second member, wherein the second member includes a first portion operatively coupled to the elastomeric member and a second portion extending toward the first member; and

a seal operatively coupled to at least one of the first member and the second member.

2. The vibration isolator of claim 1, wherein the second portion is tubular and is adapted to be coupled to the handle by a substantially cylindrical flange extending from the handle, securable and sealable via a clamp and o-rings, such that the handle slidably rotates relative to the vibration isolator.

3. The vibrator isolator of claim 1, wherein the elastomeric member encircles the first member to aid in sealing the first member to the motor housing.

4. The vibration isolator of claim 1, wherein the first member includes at least one aperture extending therethrough; and

wherein the first member is adapted to be coupled to the motor housing by a fastener extending through said at least one aperture.

5. The vibration isolator of claim 1, wherein the second member is adapted to be coupled to the handle having an inlet passage and an outlet passage extending therethrough; and

wherein the vibration isolator further includes an opening for communication between the motor housing and inlet and outlet passages.

6. The vibration isolator of claim 5, wherein the second portion is adapted to be coupled to an intake seal to seal the inlet passage to the motor housing.

7. The vibration isolator of claim 6, wherein a passage is formed between the couplable intake seal and the opening in the vibration isolator.

8. The vibration isolator of claim 1, wherein the second member is adapted to be coupled to the handle having a throttle valve actuatable by a trigger device for the power tool.

9. The vibration isolator of claim 1, wherein the elastomeric member encircles the second member to aid in sealing the second member to the handle.

10. The vibration isolator of claim 1, further comprising a central opening through which air passes, and wherein the central opening is couplable in non-alignment with a longitudinal axis of the motor housing.

11. The vibration isolator of claim 1, wherein the seal is an O-ring adapted to be attached between one of the first member and the motor housing and the second member and the handle.

12. The vibration isolator of claim 1, wherein at least one of the first member and the second member are at least partially embedded within the elastomeric member to form a seal.

* * * * *

US006651862B2

(12) **United States Patent**
Driscoll et al.

(10) **Patent No.: US 6,651,862 B2**
(45) **Date of Patent: Nov. 25, 2003**

(54) **TRIM-TYPE FASTENER DRIVING TOOL**

(75) Inventors: **Patrick J. Driscoll**, Prospect Heights, IL (US); **Robert Scott Buetow**, Lake in the Hills, IL (US); **Marc Largo**, Gurnee, IL (US); **Peter D. Ploss**, Gurnee, IL (US)

(73) Assignee: **Illinois Tool Works Inc.**, Glenview, IL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 147 days.

(21) Appl. No.: **09/845,422**

(22) Filed: **Apr. 30, 2001**

(65) **Prior Publication Data**

US 2002/0158103 A1 Oct. 31, 2002

(51) **Int. Cl.**[7] **B25C 5/06**
(52) **U.S. Cl.** **227/123**; 227/120; 227/127
(58) **Field of Search** 227/120, 123, 227/127, 128

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,775,764 A	*	1/1957	Maynard	227/123
3,273,777 A	*	9/1966	Juilfs et al.	227/123
3,934,778 A	*	1/1976	Males	227/123
4,436,236 A	*	3/1984	Jobe	227/123
4,467,952 A	*	8/1984	Morrell, Jr.	227/123
4,549,681 A	*	10/1985	Yamamoto et al.	227/123
4,942,996 A		7/1990	Wolfberg et al.	
5,238,168 A	*	8/1993	Oda	227/123
5,350,103 A	*	9/1994	Monacelli	227/123
5,427,298 A		6/1995	Tegtmeier	
5,452,835 A		9/1995	Shkolnikov	
5,653,371 A	*	8/1997	Hou	227/120
5,839,638 A		11/1998	Ronn	
6,012,622 A	*	1/2000	Weinger et al.	227/120
6,036,072 A	*	3/2000	Lee	227/120
6,056,182 A	*	5/2000	Chen	227/123
6,076,722 A	*	6/2000	Huang	227/123
6,176,412 B1		1/2001	Weinger et al.	
6,179,192 B1		1/2001	Weinger et al.	
6,267,284 B1	*	7/2001	Clark	227/120

* cited by examiner

Primary Examiner—John Sipos
Assistant Examiner—Louis Huynh
(74) *Attorney, Agent, or Firm*—Lisa M. Soltis; Mark W. Croll; Donald J. Breh

(57) **ABSTRACT**

A powered tool constructed to drive a fastener into a workpiece includes a nosepiece assembly including a back plate and a front plate combining to define a path for a driver blade, the front plate being pivotally movable relative to the back plate between a closed position, in which the front plate and the back plate are in contact with each other, and an open position. The front plate is movable to an interim deflecting position between the closed position and the open position. A handle portion has an outer surface at least partially defining a grip, and an inner surface at least partially defining a chamber. The handle portion includes a substrate having at least one aperture, and an overmold configured for forming a gripping surface on the outer surface and for extending through the apertures into the chamber for forming a resilient mounting point.

10 Claims, 5 Drawing Sheets

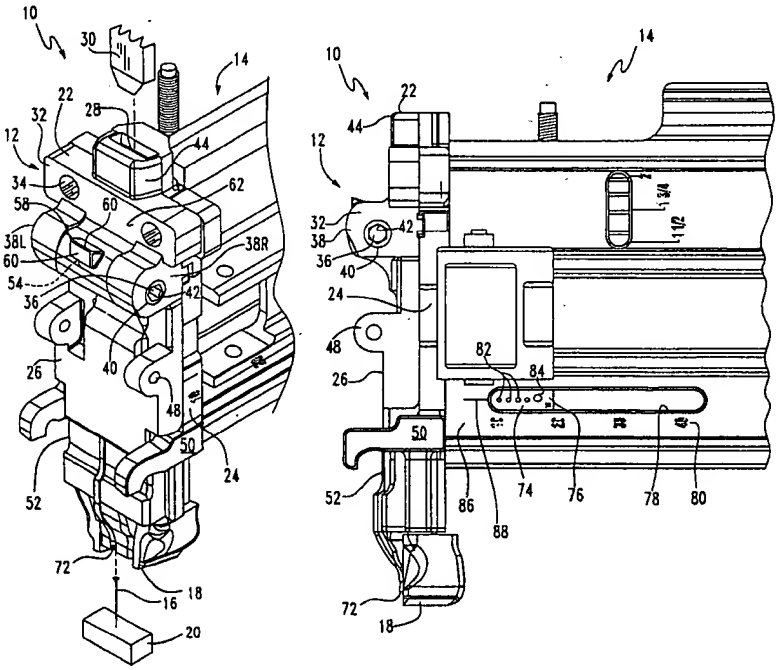


FIG. 1

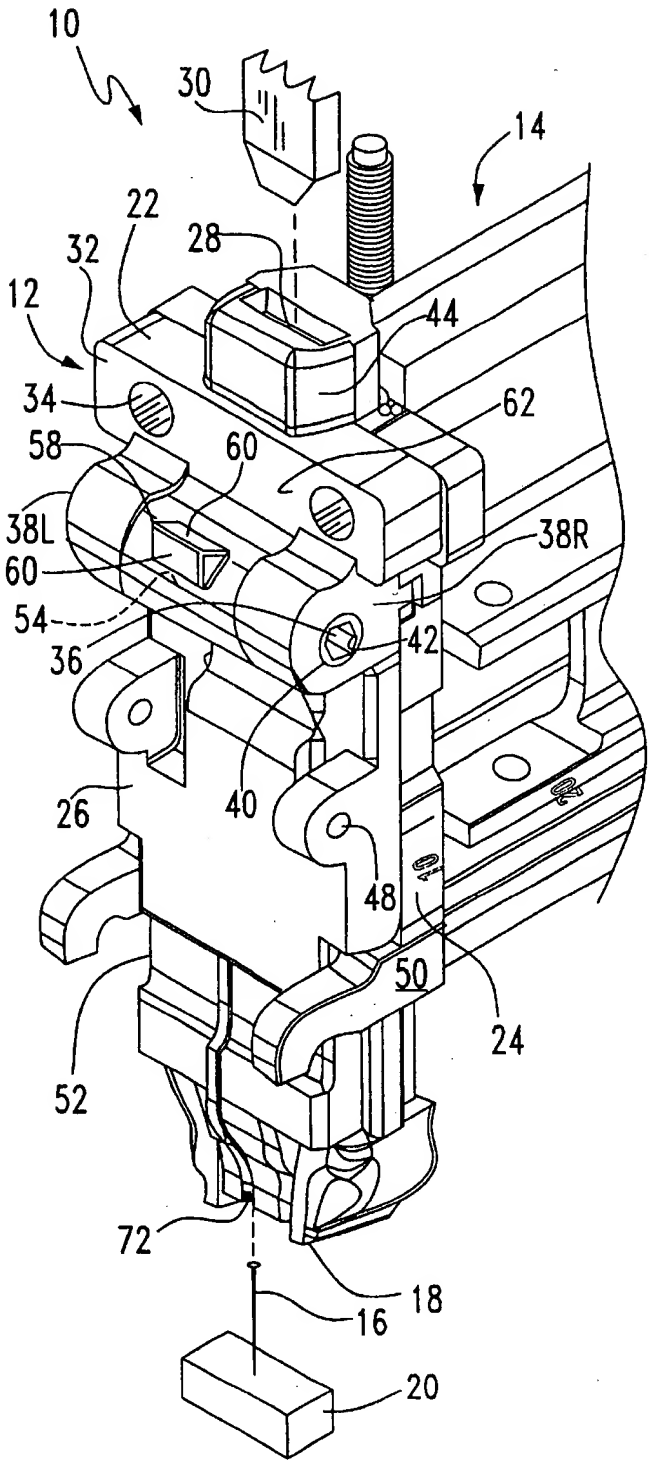

10
30
14
22
28
32
12
44
34
62
58
60
38L
38R
60
54
42
36
26
40
48
50
24
52
72
18
16
20

FIG. 3

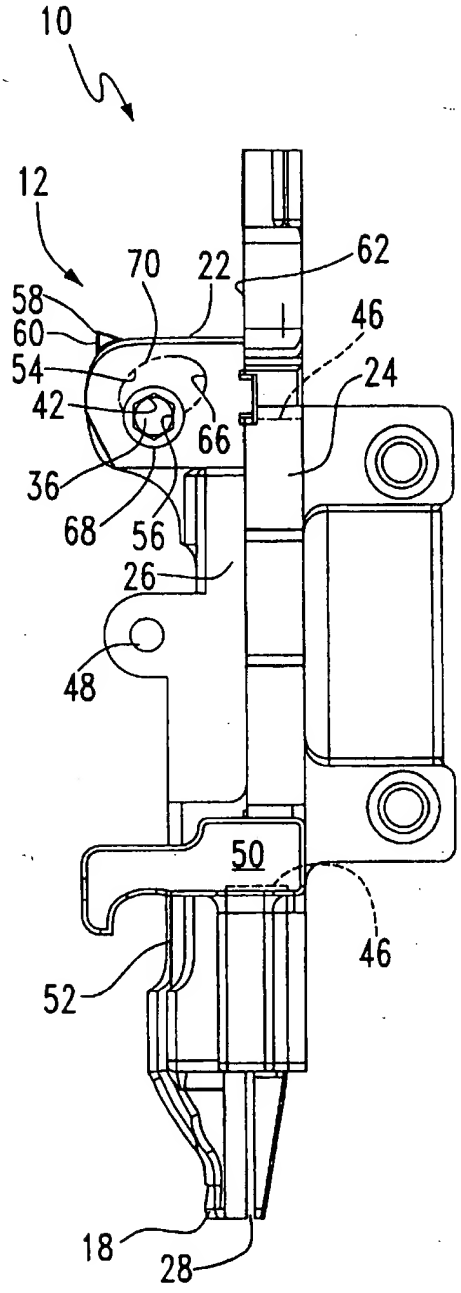
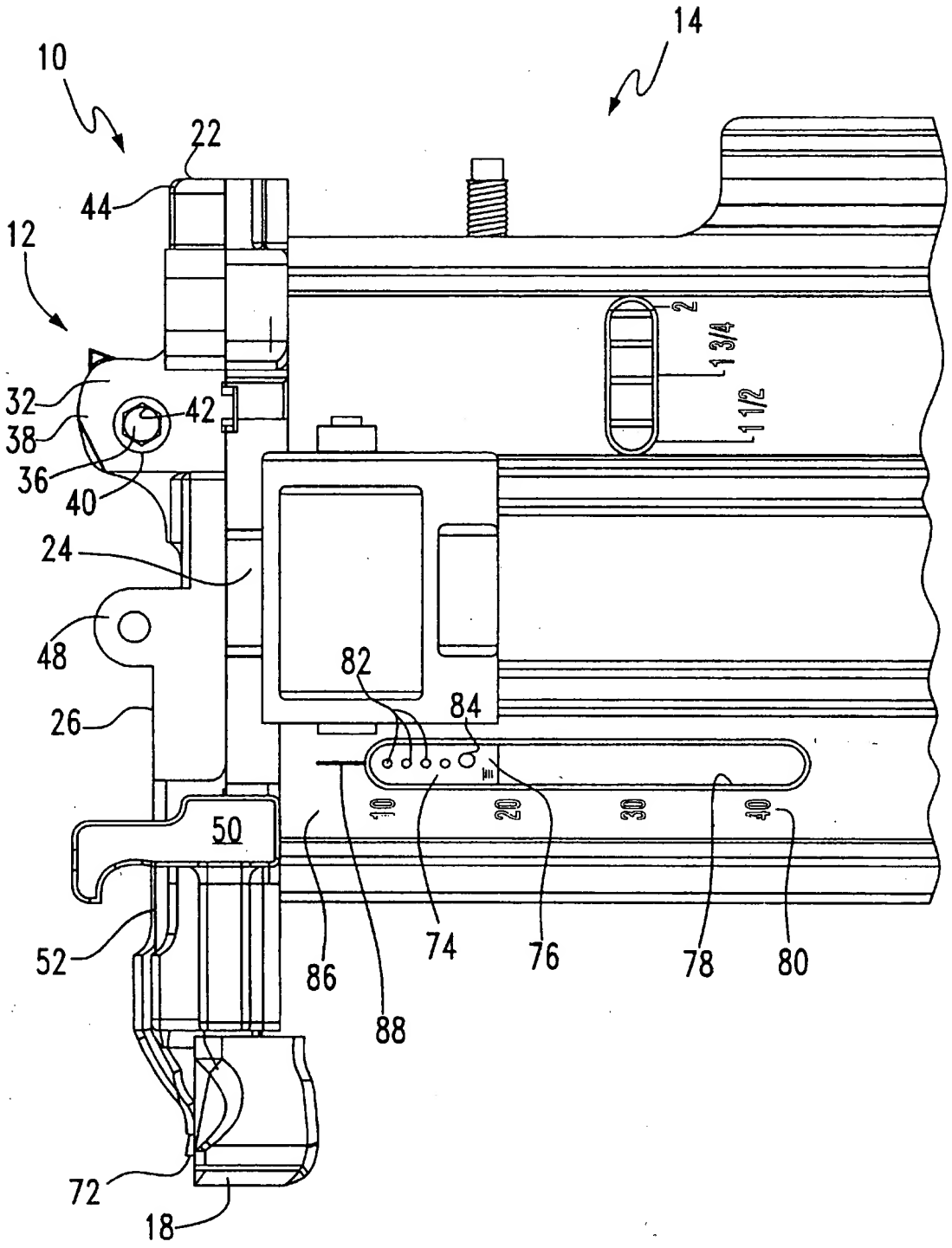

10
12
70
22
62
58
60
46
54
24
42
66
36
68
56
26
48
50
46
52
18
28

FIG. 2


14
10
22
44
12
32
38
36
40
42
24
48
26
50
52
72
18
82
84
86
88
74
76
78
80
2
1 3/4
1 1/2
10
20
30
40

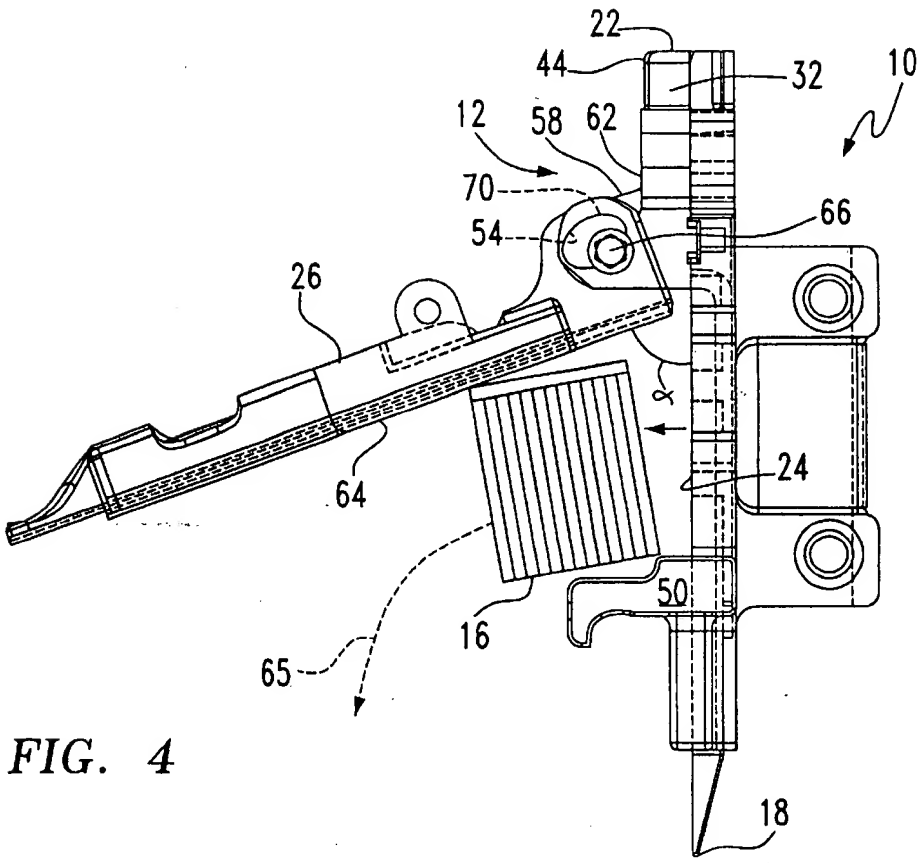

22
44
32
10
12
58
62
70
66
54
26
24
64
50
16
65
18

FIG. 4

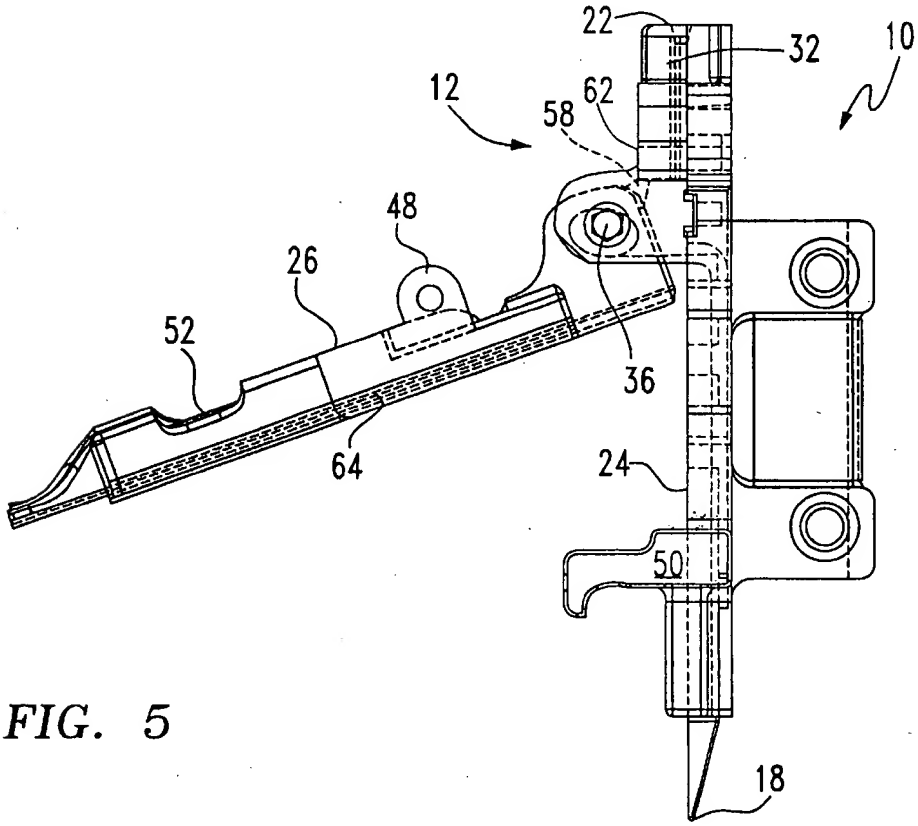

22
32
10
12
62
58
48
26
52
36
64
24
50
18

FIG. 5

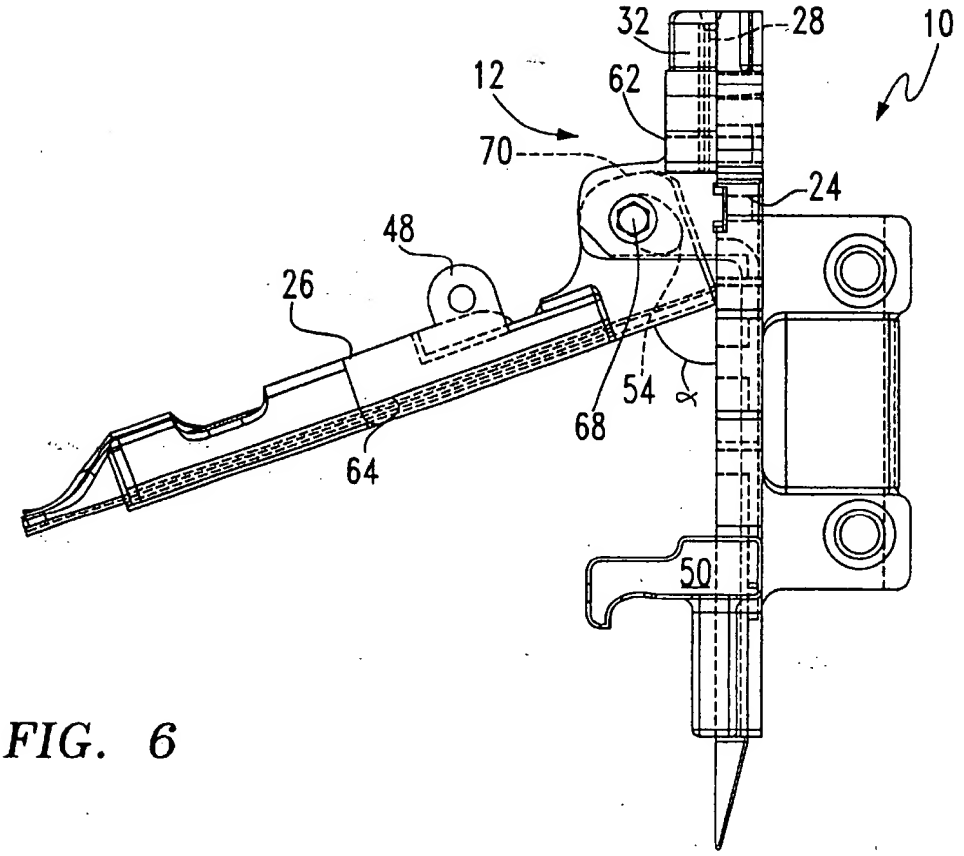

32
28
10
12
62
70
24
48
26
54
68
64
50

FIG. 6

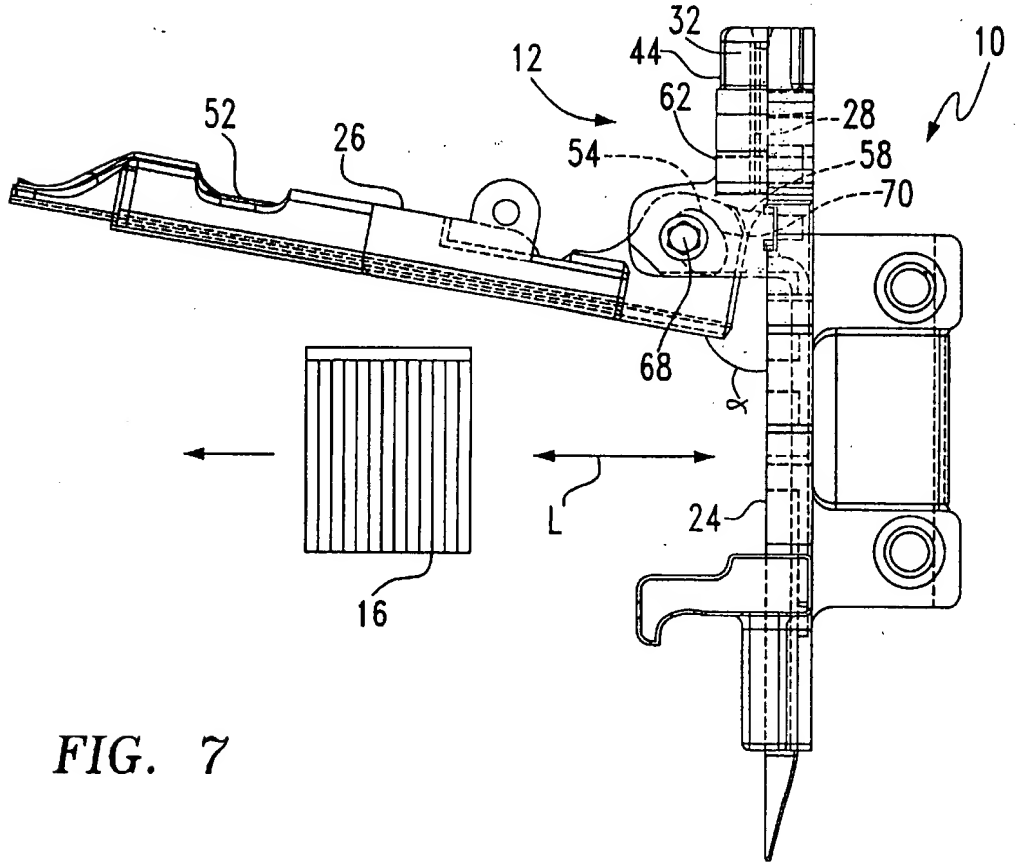

32
44
12
10
62
52
26
28
54
58
70
68
L
24
16

FIG. 7

FIG. 8

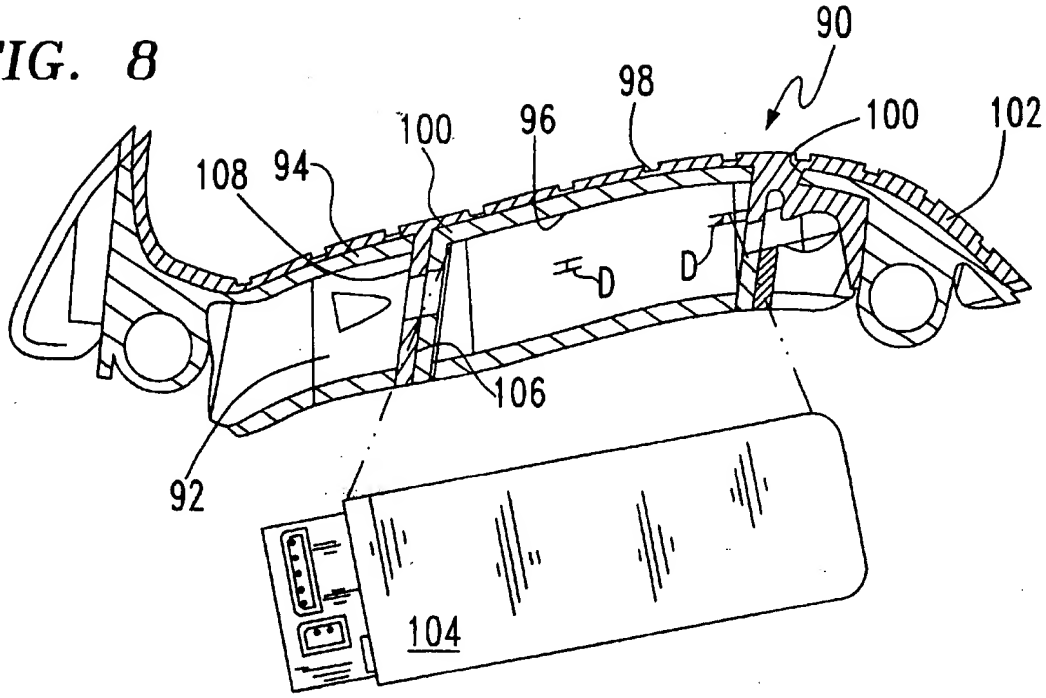
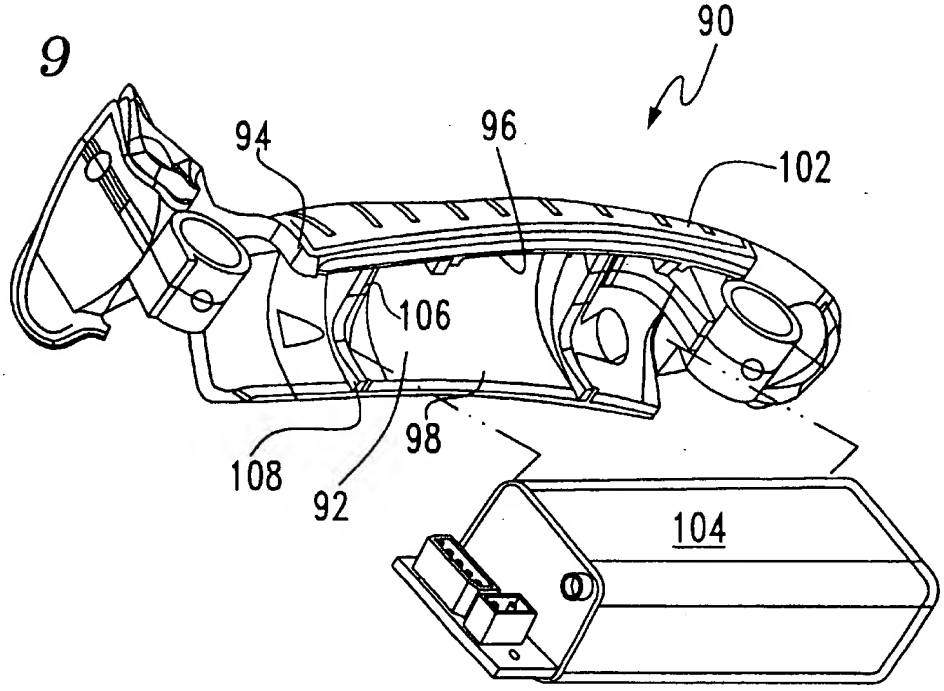

90
98
100
96
100
102
108
94
D
D
106
92
104

FIG. 9


90
94
96
102
106
98
108
92
104

TRIM-TYPE FASTENER DRIVING TOOL

BACKGROUND OF THE INVENTION

The present invention relates generally to improvements in fastener driving tools, and specifically to such tools used in the installation of trim, other decorative applications and finishing applications utilizing relatively small fasteners, fasteners made of relatively thin wire stock, and/or used with relatively small and/or delicate workpieces. The foregoing will generally be referred to as "trim applications." Included in the present tool are several features intended to make the manufacture, use and/or repair of such tools more efficient.

Portable combustion powered tools for use in driving fasteners into workpieces are described in commonly assigned patents to Nikolich, U.S. Pat. Nos. Re. 32,452; 4,403,722; 4,483,473; 4,483,474; 4,552,162; 5,197,646 and 5,263,439, all of which are incorporated herein by reference. Such combustion powered tools particularly designed for trim applications are disclosed in commonly assigned U.S. Pat. No. 6,016,622, also incorporated by reference herein. Similar combustion powered nail and staple driving tools are available from ITW-Paslode under the IMPULSE® brand.

Such tools incorporate a generally pistol-shaped tool housing enclosing a small internal combustion engine. The engine is powered by a canister of pressurized fuel gas also called a fuel cell. A battery-powered electronic power distribution unit or electronic sending unit produces the spark for ignition, and a fan located in the combustion chamber provides for both an efficient combustion within the chamber, and facilitates scavenging, including the exhaust of combustion by-products. The engine includes a reciprocating piston having an elongate, rigid driver blade disposed within a piston chamber of a cylinder body.

A wall of the combustion chamber is axially reciprocable about a valve sleeve and, through a linkage, moves to close the combustion chamber when a workpiece contact element at the end of a nosepiece, or nosepiece assembly, connected to the linkage is pressed against a workpiece. This pressing action also triggers the introduction of a specified volume of fuel gas into the combustion chamber from the fuel cell.

Upon the pulling of a trigger, which causes the ignition of the gas in the combustion chamber, the piston and the driver blade are shot downward to impact a positioned fastener and drive it into the workpiece. As the piston is driven downward, a displacement volume enclosed in the piston chamber below the piston is forced to exit through one or more exit ports provided at a lower end of the cylinder. After impact, the piston then returns to its original or "ready" position through differential gas pressures within the cylinder. Fasteners are fed into the nosepiece from a supply assembly, such as a magazine, where they are held in a properly positioned orientation for receiving the impact of the driver blade.

One operational characteristic of such tools employed in trim applications is that commercially available fasteners are typically provided in elgongate strips of individual fasteners held together with adhesive, not unlike conventional office staples. It is common for such fasteners to become jammed in the nosepiece. Thus, provisions are made in known trim-type fastener driving tools for the user to access the interior of the nosepiece to remove the jammed fasteners.

In one known embodiment, a front plate of the nosepiece assembly is pivotable outward to permit full access to the interior of the nosepiece. The front plate is preferably pivotable to at least 90° relative to the vertical operational

axis of the tool for enabling the operator to pull out the jammed fasteners perpendicularly to the action of the piston. One drawback of such an arrangement is that if the operator neglects to relieve the spring pressure of the magazine against the fasteners, once the jam is cleared, additional fasteners may be uncontrollably ejected from the nosepiece, potentially causing injury or damage.

Another operational characteristic of known trim-type fastener driving tools is that, to avoid user fatigue, designers are constantly trying to improve the ergonomics of the tool, including reducing weight and adjusting balance. One aspect of such a design objective is that the nosepiece has been moved closer to the combustion chamber to reduce the height of the tool. A drawback of this type of design is that the pivoting action of the front plate is restricted, and can no longer reach a fully open position. This restricts access to the jammed fasteners, in that the user must work around the partially-opened front plate to access the jam. However, an advantage of this restricted pivoting action is that if the magazine spring force has not been disconnected, upon clearing of a jam, fasteners ejected from the nosepiece are deflected by the front plate to avoid injury and/or damage.

Another operational characteristic of such tools is that significant impact forces are generated in the combustion and driving of the driver blade. Also, the tools are sometimes dropped from a height during use or transport. These impacts have been known to damage the sensitive electronic components of the tool, such as, but not limited to the electronic sending unit. To reduce such impacts, it is known to apply a shock absorbing caulk around the sending unit, which in some tools is located inside the handle portion. However, a drawback of this technique is that the caulk is messy to apply during manufacturing, and also makes service and repair of the sending unit more difficult.

Still another operational characteristic of such tools is that it is important to avoid firing the tool when the magazine is empty of fasteners. If so, the driver blade can cause a mark in the workpiece, which is very undesirable in appearance-intensive trim applications. It is known to provide magazines with indicators of the impending depletion of the fasteners in the magazine. However, these known devices do not provide the number of fasteners remaining just prior to the emptying of the magazine. Since operators of such tools often change the type and/or length of fasteners, it is desirable to have an accurate indication of when the magazine will become depleted.

Thus, it is an object of the present invention to provide an improved fastener driving tool which provides for the deflection of ejected fasteners upon the clearance of a fastener jam, and also is fully openable for the clearance of more complicated jams, or jams of longer fasteners.

Another object of the present invention is to provide an improved fastener driving tool which has a relatively short profile, but is also fully accessible for clearing jammed fasteners.

Still another object of the present invention is to provide an improved fastener driving tool in which the handle portion provides shock absorption to the electronic sending unit without the use of shock absorbing caulk.

A further object of the present invention is to provide an improved fastener driving tool having a fastener magazine with an indicator of the number of fasteners remaining just before the magazine is depleted.

BRIEF SUMMARY OF THE INVENTION

The above-listed objects are met or exceeded by the present trim-type fastener driving tool, which features a

front plate which is pivotable relative to the nosepiece to permit access, and which has two jam clearing positions: a first position which deflects fasteners ejected after the jam is cleared, and a second, fully accessible open position which permits axial extraction of jammed fasteners. In addition, the handle portion is preferably provided in its interior with a resilient cushion for protecting a delicate item stored within the handle, such as an electronic sending unit, which avoids the use of shock-absorbing caulk. Preferably, the cushion is part of a resilient gripping surface found on the outside of the handle. Also, the magazine is preferably provided with an indicator of the number of fasteners remaining just before the magazine becomes depleted.

More specifically, a powered tool constructed to axially drive a driver blade to impact and drive a fastener into a workpiece includes a nosepiece assembly including a back plate and a front plate combining to define a path for the driver blade, the front plate being pivotally movable relative to the back plate between a closed position, in which the front plate and the back plate are in contact with each other, and an open position. The front plate is movable to an interim deflecting position between the closed position and the open position.

In an alternate embodiment, a powered tool constructed to axially drive a driver blade to impact and drive a fastener into a workpiece includes a handle portion with an outer surface at least partially defining a grip, and an inner surface at least partially defining a chamber, preferably for an electronic sending unit. The handle portion includes a substrate having at least one aperture, and an overmold configured for forming a gripping surface on the outer surface, the overmold also being configured for extending through at least one of the apertures into the chamber for forming at least one resilient mounting point for the electronic sending unit.

In a further alternate embodiment, a powered tool constructed to axially drive a driver blade to impact and drive a fastener into a workpiece includes a nosepiece assembly including a back plate defining an aperture through which fasteners are fed for engagement with the driver blade, a front plate at least partially covering the aperture, and a magazine for dispensing fasteners to the aperture. The magazine has an indicator for indicating how many fasteners are remaining just prior to the magazine becoming empty.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. **1** is a fragmentary perspective view of the present tool, illustrating the nosepiece assembly and the magazine;

FIG. **2** is a side view of the structure of FIG. **1**;

FIG. **3** is a side view of the tool of FIG. **1**, with portions omitted for clarity;

FIG. **4** is a side view of the tool of FIG. **1** illustrating the deflection position;

FIG. **5** is a view of the tool of FIG. **4** shown in a first partially disengaged position;

FIG. **6** is a view of the tool of FIG. **4** shown in a second partially disengaged position;

FIG. **7** is a view of the tool of FIG. **4** shown in a fully opened position;

FIG. **8** is a vertical section of the handle portion showing the electronic sending unit exploded away; and

FIG. **9** is a perspective view of the embodiment of FIG. **8**.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to FIGS. **1** and **2**, a combustion powered tool suitable for driving trim-type fasteners is fragmentarily shown and generally designated **10**. It will be understood that features described below are particularly suitable for trim-type fasteners, however it is also contemplated that they may find application with combustion powered tools used for other applications. The general appearance and operational details of such combustion powered tools for both general and trim-type applications are described in greater detail in the patents which have been incorporated by reference.

In FIG. **1**, the main illustrated components are a nosepiece assembly **12** and a fastener magazine **14**. The tool **10** is shown in a generally vertical orientation, with fasteners **16** driven through a lower end **18** of the nosepiece assembly **12** into a workpiece **20**, however other orientations of the tool **10** are contemplated as known in the art. Opposite the lower end **18** is an upper end **22** of the nosepiece assembly **12**.

Included in the nosepiece assembly **12** are a generally planar back plate **24** and a generally planar front plate **26**, which combine to define a path or track **28** for a driver blade **30**. The track **28** extends the full length of the nosepiece assembly **12** to the lower end **18**. A front plate support **32** is secured to the back plate **24**, preferably by fasteners (not shown) passing through corresponding bores **34** in the support and the back plate. The main purpose of the front plate support **32** is to provide a pivot point or axis **36** for the front plate **26**. However, other arrangements providing such a pivot axis are contemplated, including providing a pivot point integrally formed on the back plate **24**. In the preferred embodiment, the pivot axis **36** is defined by a pair of spaced, co-axial bosses **38** each defining a throughbore **40**. At least one of the throughbores **40** is internally threaded or otherwise configured for lockingly receiving a pivot pin **42**. An upper end **44** of the front plate support **32** also helps define the track **28**.

As described above, an important concern of users of such fastener tools **10** is that there should be access to the interior of the nosepiece assembly **12** to enable the clearance of jammed fasteners. Specifically, there is an aperture **46** (shown hidden in FIG. **3**) in the back plate **24** through which fasteners **16** are urged from the magazine **14**. This aperture **46** often becomes filled or jammed with at least one fastener **16** and must be cleared for the resumption of normal operation of the tool **10**. In the preferred embodiment, such access is obtained by having the front plate **26** be pivotable relative to the back plate **24**.

Referring now to FIGS. **1–3**, this pivoting action begins from a closed position in which the front plate **26** and said back plate **24** are in contact with each other, which is also the normal operating position of the tool **10**. The closed position is maintained by a releasable spring clamp (not shown) which, in the preferred embodiment, is an over-center cam type well known in the art of trim-type fasteners for this purpose. The clamp is mounted to eyelets **48** on the front plate **26**, retainer arms **50** on the back plate **24**, and a recess **52**, also located on the front plate. Other mounting formations are contemplated for securing any suitable clamp in operational relationship to the nosepiece assembly **12**.

In the preferred embodiment, the pivoting action is obtained by an upper end of the front plate **26** being provided with a pivot bore **54** which is preferably noncircular, and which accommodates the pivot pin **42**. The pin is shown with a hex recess **56**, and is preferably threaded at its tip to engage the throughbore **40** in the left boss **38L**, after it slidingly passes through the throughbore **40** in the right boss **38R** and the pivot bore **54**. While the above-described arrangement is preferred, other structures for

obtaining a pivoting relationship between the front plate **26** and the rear plate **24** are contemplated, such as, but not limited to having the pin **42** fixed to the front plate and engaged in U-shaped grooved bores **40**, having two bores **40** on the front plate and the pivot bore **54** on the rear plate, and having the two bores **40** located elsewhere on the nosepiece assembly **12** or on the tool **10**.

Referring now to FIGS. **3** and **7**, the front plate **26** is generally freely pivotable between the closed position (FIG. **3**) and an open position (FIG. **7**). In the present application, the "open position" will be referred to as a fully open position of the front plate **26** in which fasteners **16** jammed in the aperture **46** are extractable along a longitudinal axis "L" (FIG. **7**) generally perpendicular to the plane of the back plate **24**. In the preferred embodiment, the front plate **26** in the open position is at an angle α of least 90°, however other angles are contemplated depending on the height of the fasteners **16**.

As described above, one drawback of prior art trim-type tools is that in some cases, the user forgets to release the spring bias exerted by the magazine **14** against the fasteners **16** ready to be driven by the driver blade **30**. Upon the extraction of the jammed fastener, the remaining fasteners (sometimes in strip form, as seen in FIG. **7**) can be ejected from the aperture **46** under force, which may cause injury and/or damage.

Referring to FIG. **1**, an important feature of the present nosepiece assembly **12** is a stop **58** configured for preventing the otherwise free pivoting action of the front plate **26** to the open position and creating an interim deflecting position for the front plate **26** between the closed position and the open position.

In the preferred embodiment, the stop **58** is secured to the front plate **26**, preferably integrally, and projects generally radially from the pivot bore **54**. The stop **58** also takes the general form of a right angle, having a pair of walls **60**. Other types of attachment and configuration for the stop **58** are contemplated as are known in the art for enabling the stop to engage the nose assembly **12** for preventing the front plate **26** from reaching the open position.

Referring now to FIGS. **1** and **4**, the stop **58** engages a surface **62** on the front place support **32** to define an interim or deflection position. This position is so named because of the way an inner surface **64** of the front plate **26** will deflect any ejected fasteners **16** which are released by the user pulling the jammed fastener from the aperture **46**. The deflection position, in which an angle α is preferably in the range of 69–70°, tends to protect the user and surrounding property from injury and/or damage from ejected fasteners. A fragmentary fastener strip **16** is shown being ejected and deflected along a path **65**. The deflection position is also useful in deflecting broken pieces of jammed fasteners which may be ejected from the aperture **46**. In addition, in many cases a jam may be cleared without opening the front plate **26** to the open position (FIG. **7**).

Referring to FIGS. **1** and **3–7**, another feature of the present tool **10** is that it has a relatively low profile, in that the nosepiece assembly **12** is mounted relatively close to the combustion chamber (not shown). Due to this arrangement, special efforts must be made to provide the front plate **26** with the ability to pivot fully to the open position (FIG. **7**). In addition, to reach the open position, the nosepiece assembly **12** is preferably equipped with a structure for enabling the disengagement of the stop **58** from the surface **62**.

In the preferred embodiment, the disengagement structure takes the form of the noncircular pivot bore **54**, which defines a first pivot axis **66** for pivoting action to the deflecting position (FIG. **4**), and a second pivot axis **68** (FIGS. **6** and **7**) for enabling disengagement between the stop **58** and the surface **62** for achieving the open position. In addition, the pivot bore **54** also defines a transition surface **70** to allow the user to shift the front plate **26** downward and forward so that disengagement is achieved. This shift can be seen in FIG. **5**, where it is evident that the stop **58** has now been moved beneath the surface **62**.

Referring now to FIG. **6**, once disengagement has occurred, the front plate **26** is now free to pivot about the second axis **68** to the open position (FIG. **7**), in which the stop **58** is totally out of contact with the front plate support **32**. It will also be seen from FIG. **3** that the pivot bore **54** is generally heart-shaped, although other noncircular shapes are contemplated for achieving the dual pivot points and the above-described disengagement.

Referring now to FIGS. **1** and **2**, another feature of the present front plate **26** is at least one aiming formation **72** for facilitating the location of the nosepiece assembly **12**, and specifically the lower end **18** relative to the workpiece **20** for accurate placement of fasteners **16**. The aiming formation resembles the rear sight of a firearm, and defines a pair of bars between which the fastener will be placed by the driver blade **30**. Additional aiming formations are contemplated which enhance line of sight accuracy in the placement of fasteners **16**.

Referring now to FIG. **2**, still another feature of the present tool **10** is that the magazine **14** is provided with an indicator **74** for indicating how many fasteners are remaining just prior to the magazine becoming empty. Preferably, the present indicator **74** will not be effective until there are only about **15** or fewer fasteners left in the magazine **14**, with the number varying depending on the type and size of fastener employed in the tool **10**.

More specifically, the preferred form of the indicator **74** utilizes a follower **76** which is a known component of magazines, being used to exert the spring force upon the strip of fasteners to urge them toward the aperture **46**. The magazine **14** also includes at least one window **78** which provides a rough indication of the number of fasteners remaining, and may also be provided with a visual indicator or scale **80** of the number of remaining fasteners. As the number of fasteners **16** in the magazine **14** dwindles, the follower **74** will become visible through the window **78**. It is preferred that the indicator **74** take the form of a series of spaced dots or marks **82**, each representing a fastener. As the dots **82** disappear behind a wall **86** of the magazine **14** as the follower approaches the aperture **46**, the user can count the remaining dots to determine the number of remaining fasteners. It is also preferred that the very last dot **84**, representing the last fastener in the magazine **14**, be differentiated as by size or color, from the other dots, to alert the user to reload the magazine. It is also preferred that a reference line **88** is provided on the magazine wall **86** associated with, and preferably adjacent the row of dots **82** to facilitate the user's identification of the number of remaining fasteners **16**.

Referring now to FIGS. **8** and **9**, another feature of the present tool **10** relates to the construction of a handle portion **90** which provides a grip for the user, and which also defines a chamber **92**. The handle portion **90** includes an outer surface **94** for providing the grip, and an inner surface **96** for defining the chamber **92**.

In the preferred embodiment, the handle portion **90** more specifically includes a relatively stiff or rigid substrate **98** defining the inner surface **96** and the chamber **92**, and having

at least one aperture **100**, and an overmold **102** configured for forming a gripping surface on the outer surface **94**. An important feature of the present handle portion **90** is that the overmold **102** is configured for extending through the at least one aperture **100** into the chamber **92**.

As is known in the art, tools of many types, and other consumer articles are made with overmolds of relatively more resilient material to enhance gripping. Using known molding technology, the substrate **98** is made of a relatively stiff or rigid material, such as ABS polycarbonate, or the like, and the overmold **102** is made of a relatively resilient material, such as an elastomer. As an example only of the relative resiliencies of the substrate **98** and the overmold **102**, the preferred substrate has an approximate Durometer Shore Hardness of 85, and the overmold approximately 45. Although many materials are suitable, provided they have the desired resilience, a preferred overmold material, due to its ability to bond well with ABS polycarbonate, is provided by Diamond Polymer of Ohio, under the trademark SOFT FLEX.

While it is well known to provide gripping surfaces by overmolding, an additional feature of the present handle assembly **90** is that the overmold **102** also provides a shock absorbing function to an article located within the chamber **92**, such as the electronic sending unit **104** of the present tool **10**. More specifically, during the molding process, the overmold **102** flows through the apertures **100** and forms along already existing structural support ribs **106**, to form a cushion distance 'D' by projecting past and preferably radially inwardly beyond the relatively stiff ribs **106**. In this manner, the overmold **102** forms at least one resilient mounting point **108** for the sending unit **104**.

As best seen in FIG. **9**, the ribs **106** are generally "U"-shaped to partially circumscribe the sending unit **104** and more snugly retain it within the chamber **92**. Through the use of the overmold **102** creating the resilient mounting points **108**, a tight friction fit is provided for the sending unit **104** which also protects against shock impact, and is an integral piece of the gripping surface on the outer surface **94**.

Thus, it will be seen that the present tool **10** features a pivot stop/disengagement mechanism for providing both an open position and an interim, deflecting position. The former is useful for clearing difficult jams and/or jams of larger fasteners, and the latter is useful for deflecting stray fasteners released during the clearance of more normal jams. In addition, an indicator has been provided on the magazine follower which accurately indicates the number of fasteners remaining just before the magazine becomes empty. Further, the handle portion is configured so that the same resilient material forms a soft grip, while providing a shock absorbing function to fragile components located within the handle portion.

While specific embodiments of the trim-type fastener driving tool of the present invention have been shown and described, it will be appreciated by those skilled in the art that changes and modifications may be made thereto without departing from the invention in its broader aspects and as set forth in the following claims.

What is claimed is:

1. A powered tool constructed to axially drive a driver blade to impact and drive a fastener into a workpiece, said tool including a magazine configured for urging fasteners along an axis to be engaged by said driver blade, and comprising:

a nosepiece assembly including a back plate and a front plate combining to define a path for the driver blade;

said front plate being pivotally movable relative to said back plate between a closed position in which said front plate and said back plate are in contact with each other, and an open position in which said front plate is sufficiently displaceable from said back plate such that fasteners in said magazine are removable from said magazine generally along an axis defined by said magazine;

said front plate being movable to an interim deflecting position between said closed position and said open position;

a stop for retaining said front plate in said deflecting position and for preventing pivoting action of said front plate to said open position;

disengagement means for disengaging said stop for enabling said front plate to reach said open position; and

said disengagement means is a noncircular pivot bore on said front plate defining a first pivot axis enabling engagement of said stop, and a second pivot axis enabling disengagement of said stop.

2. The tool of claim **1**, wherein said stop is located on said front plate.

3. The tool of claim **2**, wherein said stop is configured for engaging said nose assembly for preventing said front plate from reaching said open position.

4. The tool of claim **1**, wherein said disengagement means defines a first pivot axis for said deflecting position, and a second pivot axis for said open position.

5. The tool of claim **1**, wherein said noncircular pivot bore is disposed on said front plate.

6. The tool of claim **1**, wherein said stop is on said front plate and further including a front plate support defining a pivot axis for said front plate and being securable to said back plate, said support defining an engagement surface for said stop.

7. The tool of claim **1** further including an aiming formation on said front plate for facilitating the location of said nosepiece assembly relative to the workpiece.

8. The tool of claim **1** further including a magazine for dispensing fasteners to said nosepiece assembly, said magazine being provided with an indicator for indicating how many fasteners are remaining just prior to the magazine becoming empty.

9. The tool of claim **8** further including a follower on said magazine, said indicator being located on said follower.

10. A powered tool constructed to axially drive a driver blade to impact and drive a fastener into a workpiece, comprising:

a nosepiece assembly including a back plate and a front plate combining to define a path for the driver blade;

said front plate being pivotably moveable relative to said back plate between a closed position in which said front plate and said back plate are in contact with each other, and an open position;

a stop on said front plate for retaining said front plate in a deflecting position and for preventing pivoting action of said front plate to said open position;

a disengagement means for disengaging said stop for enabling said front plate to reach said open position; and

said disengagement means is a noncircular pivot bore on said front plate defining a first pivot axis enabling engagement of said stop, and a second pivot axis enabling disengagement of said stop.

* * * * *

United States Patent [19]

Kawara et al.

[11] **Patent Number: 5,046,249**

[45] **Date of Patent: Sep. 10, 1991**

[54] **MOTOR DRIVEN OSCILLATING RAZOR**

[75] Inventors: **Manabu Kawara**, Otsu; **Masao Tanahashi**; **Masao Matsumoto**, both of Hikone, all of Japan

[73] Assignee: **Matsushita Electric Works, Ltd.**, Japan

[21] Appl. No.: **555,637**

[22] Filed: **Jul. 23, 1990**

[30] **Foreign Application Priority Data**

Aug. 19, 1989 [JP] Japan 1-214012
Dec. 25, 1989 [JP] Japan 1-335470

[51] **Int. Cl.**[5] **B26B 19/28**; B26B 19/38; B26B 21/16

[52] **U.S. Cl.** **30/45**; 30/44; 30/86

[58] **Field of Search** 30/42, 43.3, 43.7, 43.8, 30/43.91, 44, 45, 49, 87, 89, 458, 461

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,611,568	10/1971	Alexander et al.	30/45
3,636,627	1/1972	Tiffin	30/45
3,772,779	11/1973	Douglass et al.	30/45
4,083,102	4/1978	Harshberger	30/45
4,744,144	5/1988	Lowery, Sr. et al.	
4,819,330	4/1989	Fenn et al.	
4,914,816	4/1990	Fenn et al.	30/45

Primary Examiner—Paul A. Bell
Assistant Examiner—Paul M. Heyrana, Sr.
Attorney, Agent, or Firm—Stevens, Davis, Miller & Mosher

[57] **ABSTRACT**

An improved hand-held motor-driven oscillating razor for wet shaving provides a substantially vibration-free gripping during the shaving. The razor comprises a grip housing adapted to be gripped by the hand of a user and a shaver head movably supported on top of the grip housing. The shaver head carries a razor blade element and includes a weight which is driven by a motor to impart oscillatory movement to the shaver head. The motor is mounted within the shaver head together with the weight so as to confine an oscillatory system within the shaver head. A damper member is utilized to singly support the shaver head to the grip housing in order to made the shaver head movable with respect to the grip housing such that the grip housing can be isolated substantially from the oscillatory system in the shaver head, permitting the shaver head to oscillate substantially indpendently of the grip housing, thereby minimizing a counter-vibration transmitted back to the grip housing from the shaver head. The damper member is preferably configured to exhibit different elasticity in differing directions in order to minimize the counter vibration which the user feels during the shaving. while assuring effective shaving.

10 Claims, 8 Drawing Sheets

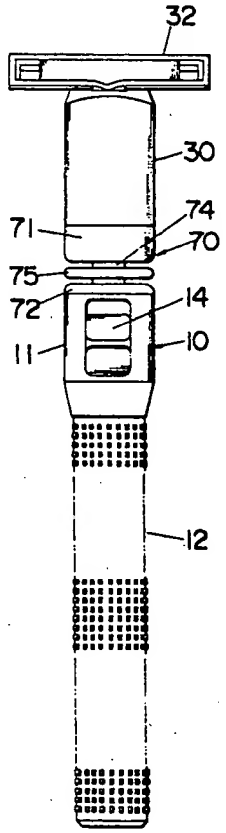


Fig. 1

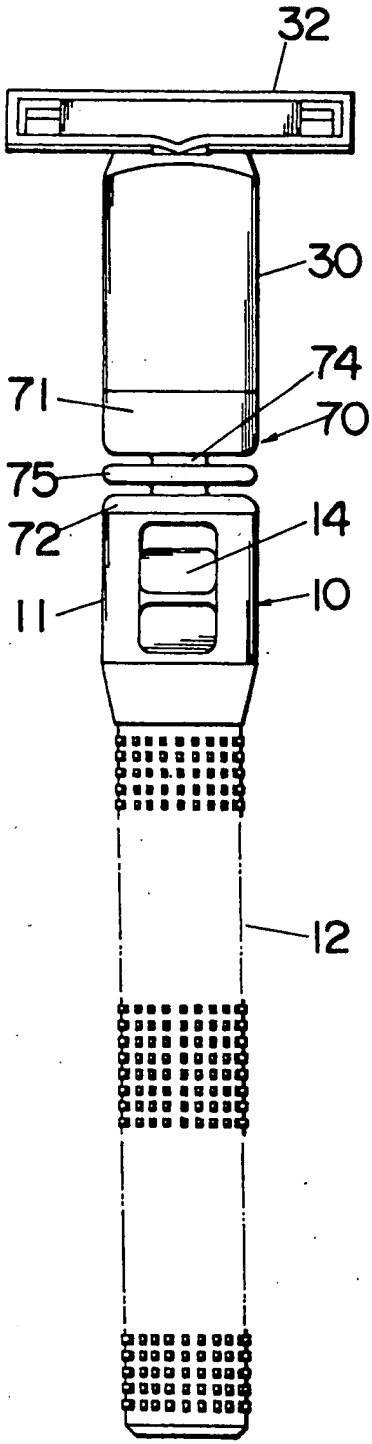


Fig. 2

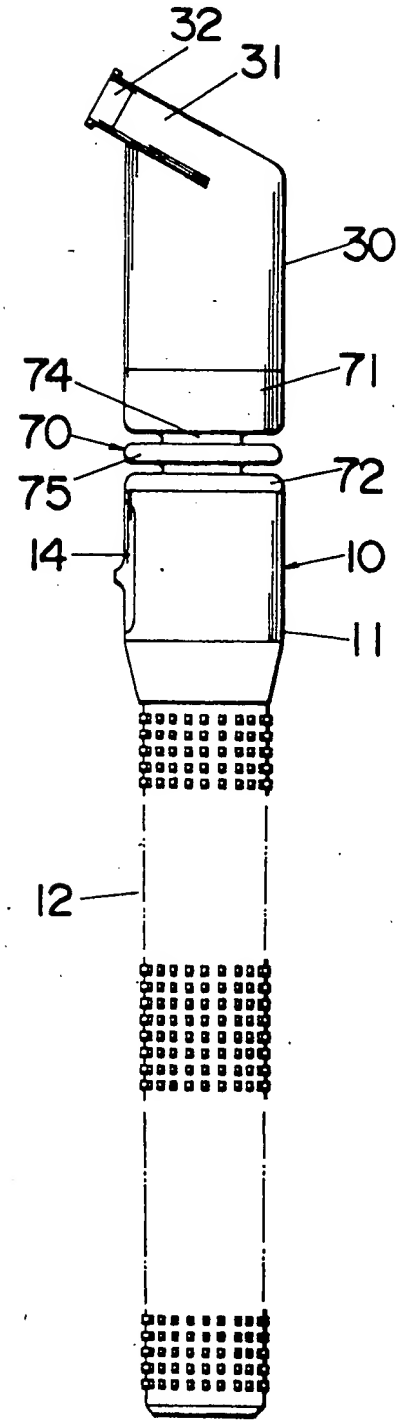


Fig.3

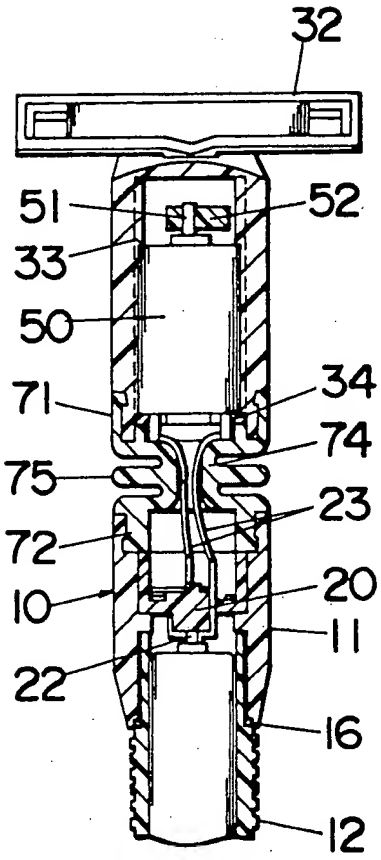

32
51
52
33
50
71
34
74
75
23
72
20
10
11
22
16
12

Fig.4

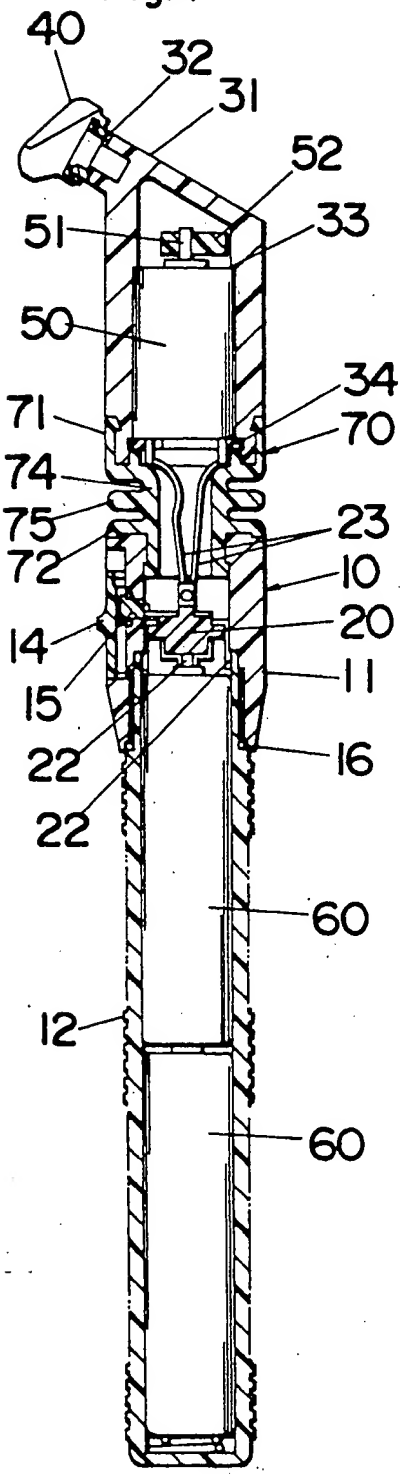

40
32
31
52
51
33
50
34
71
70
74
75
23
72
10
20
14
11
15
22
16
22
60
12
60

Fig.5

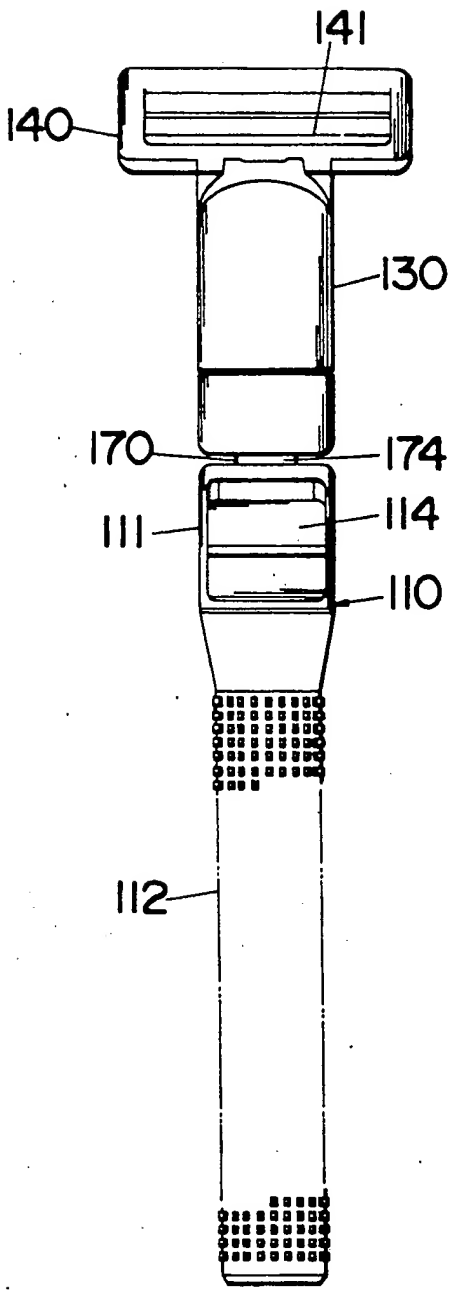

141
140
130
170
174
111
114
110
112

Fig.6

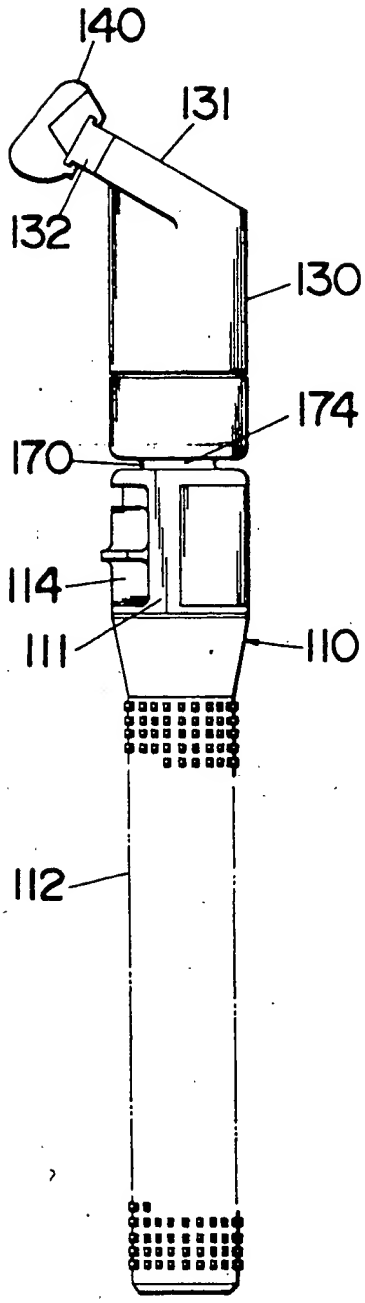

140
131
132
130
174
170
114
111
110
112

Fig.7

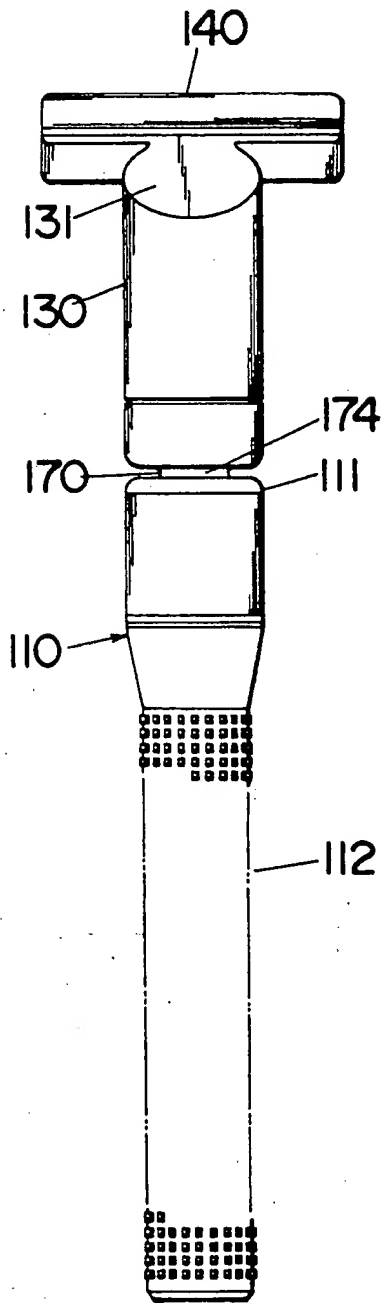


Fig.8

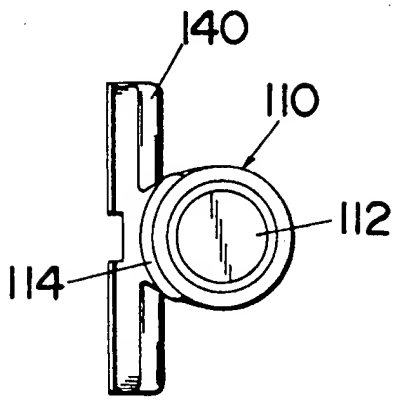


Fig.9

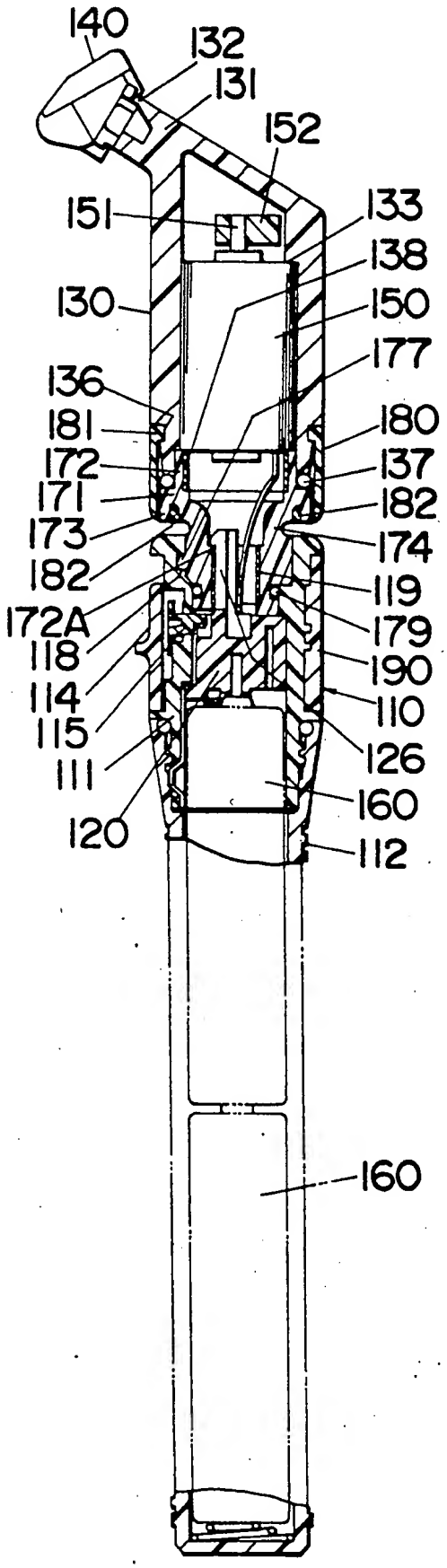

140
132
131
152
151
133
138
130
150
177
136
180
181
137
172
182
171
174
173
119
182
179
172A
190
118
110
114
126
115
160
111
112
120
160

Fig.10

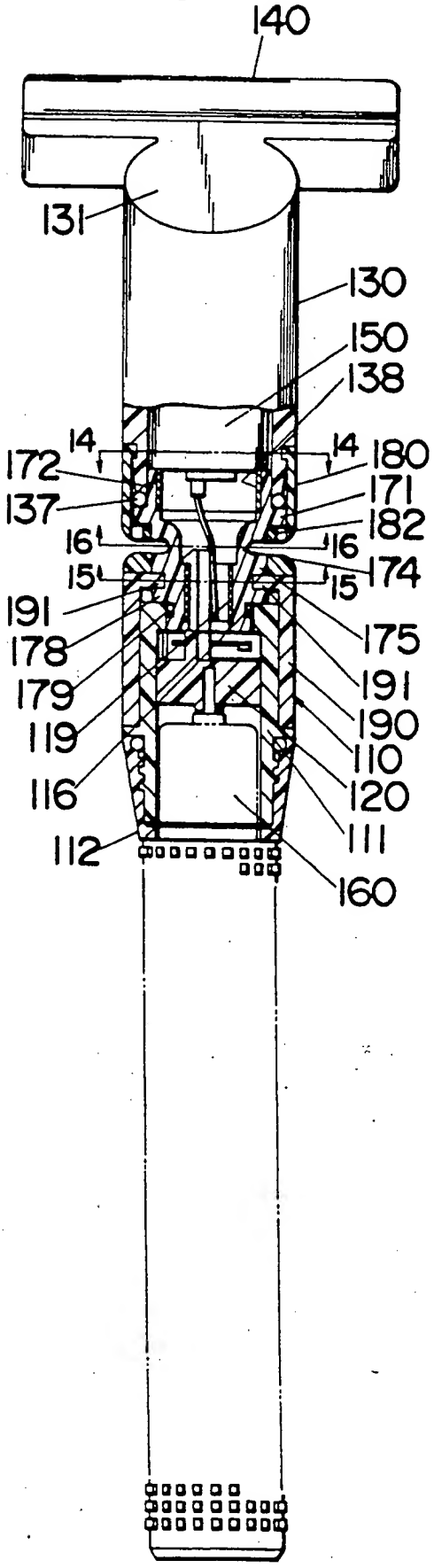

140
131
130
150
138
14
14
180
172
171
137
182
16
16
174
15
15
191
175
178
191
179
190
119
110
116
120
111
112
160

Fig.11

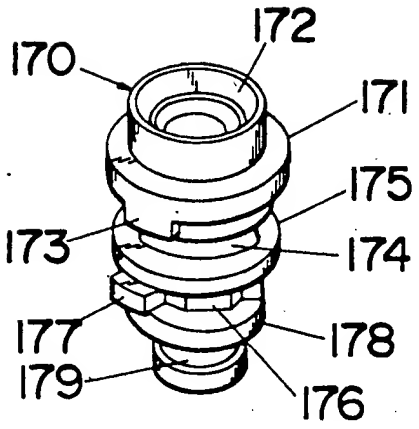


Fig.12

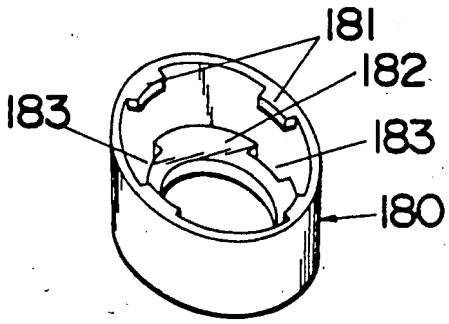


Fig.13

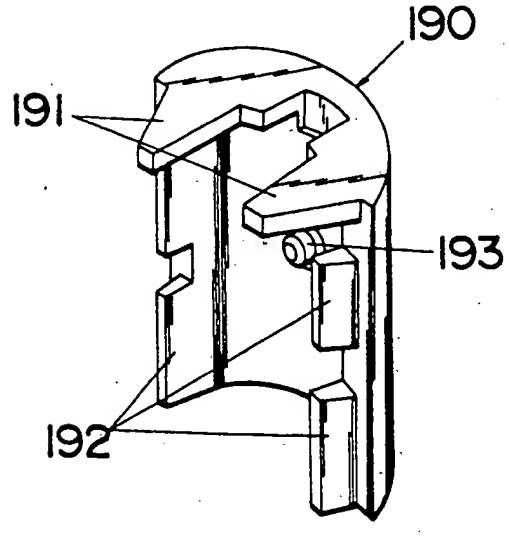


Fig.14

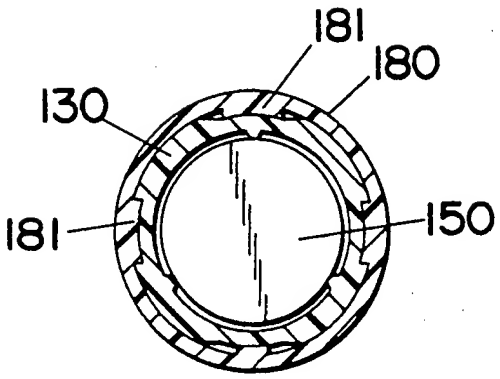


Fig.15

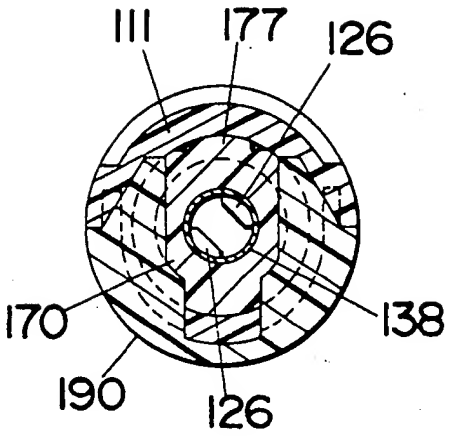


Fig.16

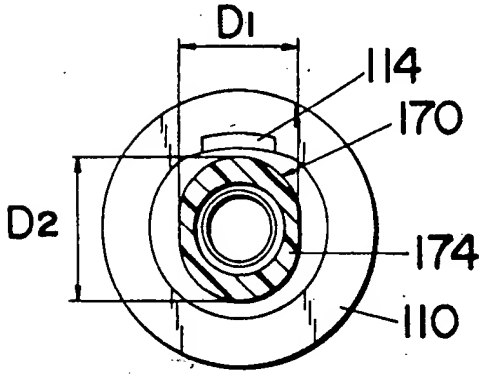


Fig.17

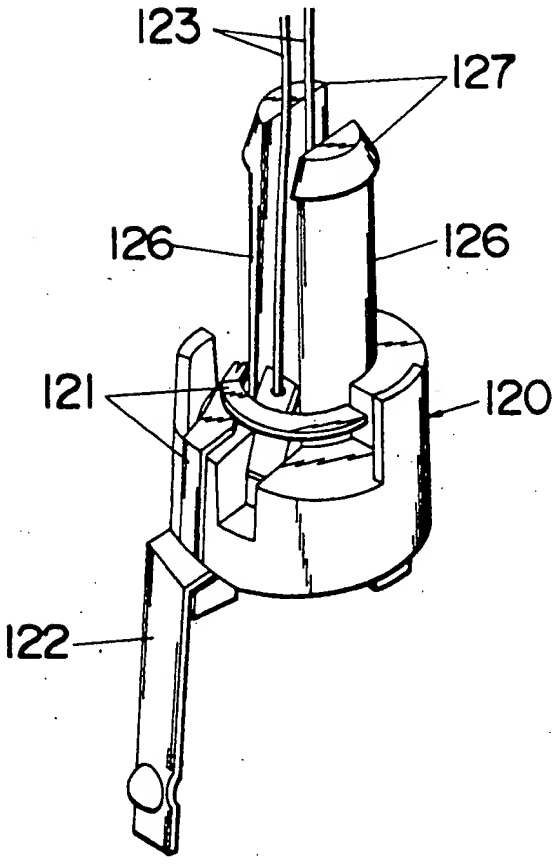


Fig.18

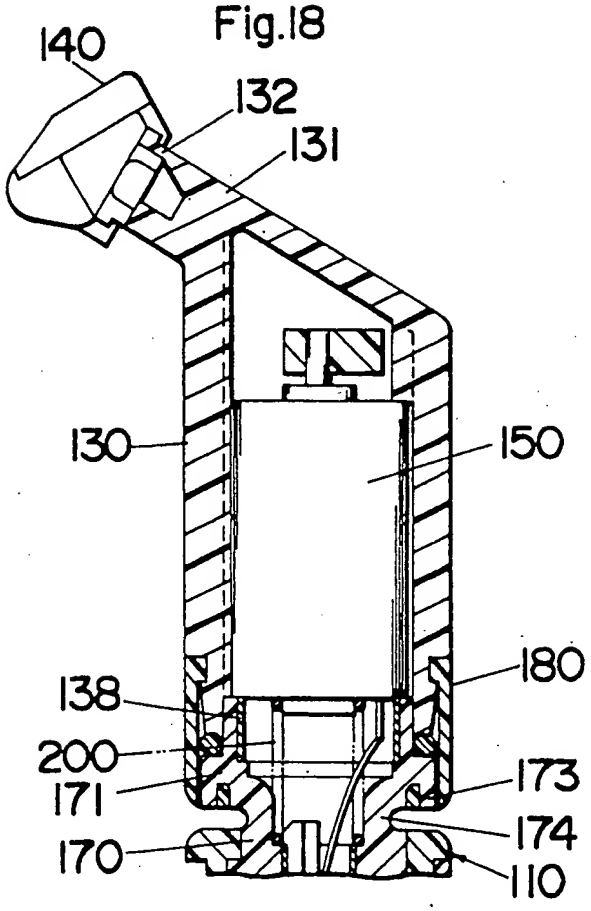
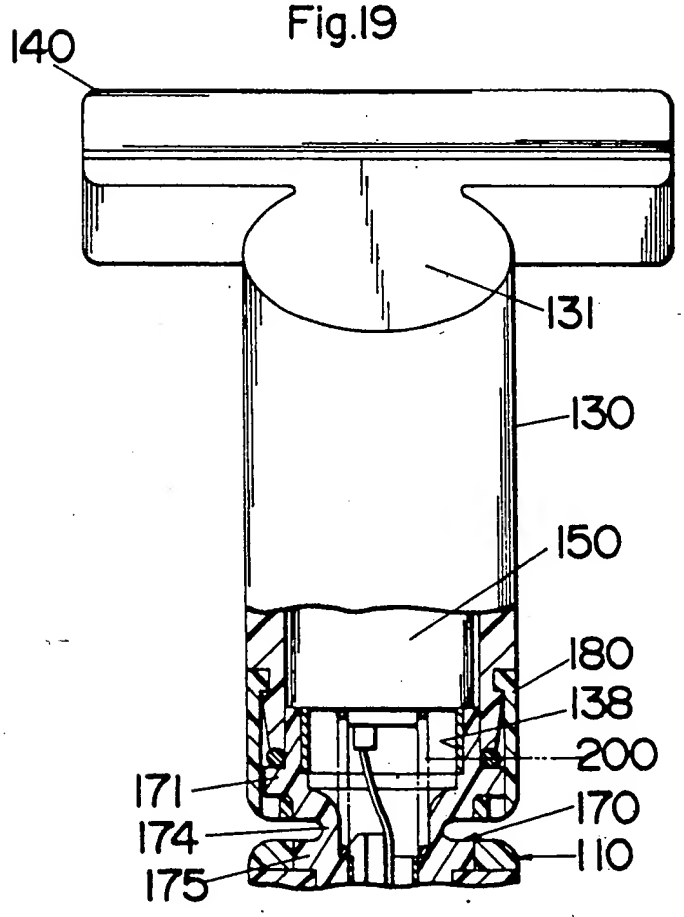

140
132
131
130
150
180
138
200
171
173
174
170
110

Fig.19


140
131
130
150
180
138
200
171
170
174
110
175

MOTOR DRIVEN OSCILLATING RAZOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is directed to a motor driven oscillating razor having a shaver head with a razor blade element which is driven by the motor to oscillate for comfortable and effective wet shave.

2. Description of the Prior Art

A number of oscillating razors have been proposed in the art in which a razor blade or blades are oscillated to provide effective or close shave. Typical prior art oscillating razor is seen in U.S. Pat. No. 4,744,144 which comprises a tubular grip housing with razor blades at its upper end. The grip housing accommodates therein an eccentric weight and a motor which rotates an eccentric weight so as to impart oscillatory movement to the whole grip housing. In this patent, since not only the razor blades but also the grip housing oscillates, an oscillatory system is required in the razor which generates a relatively great oscillatory energy in order to oscillate the razor blades together with the grip housing at a desired amplitude and frequency. Such oscillatory system must, therefore, includes physically large components, i.e., weight, motor and the other associated parts, which are likely to interfere with each other during the oscillation to thereby produce a loud noise. Further, since the grip housing itself is subject to the oscillation, the user holding the grip handle is constantly suffering from the oscillation or counter-vibration during the shaving, which is not acceptable in view of obtaining comfortable shaving and therefore hinders the widespread use of the oscillating razor of this kind.

Another prior art razor is seen in U.S. Pat. No. 4,819,330 in which a shaver head is coupled to the top of a grip housing with a resilient bushing interposed therebetween so that the shaver head can be movably mounted on the grip housing. The shaver head carries a razor blade or blades and accommodates therein a weight which is driven to reciprocate through a rotary-to-oscillation conversion mechanism also accommodated within the shaver head to impart oscillatory movement to the shaver head. Thus, the shaver head can oscillate in unison with the razor blades relatively freely with respect to the grip housing. Accordingly, it is possible with the structure of this patent to reduce the counter-vibration transmitted back to the grip housing from the shaver head. However, in this patent, because of that a motor driving the weight is still accommodated in the grip housing and that the shaver head is has its lower end inserted to an upper opening of the grip housing for connection therebetween with the resilient busing closely confined at the connection, there remains a problem that the motor will be a cause of giving a vibration to the grip housing as well as that the resilient bushing is not expected to effectively absorb the vibration of the shaver head, thus leaving a significant counter-vibration to be transmitted back to the grip housing. Therefore, this prior art device is still unsatisfactory in minimizing the counter-vibration as much as possible which the user feel during the shaving.

SUMMARY OF INVENTION

To eliminate the above insufficiencies and problems, the present invention provides an improved oscillating razor which gives substantially vibration-free gripping. The oscillating razor in accordance with the present invention comprises a grip housing adapted to be gripped by the hand of a user and a shaver head carrying a razor blade element and accommodating therein an oscillation inducing weight. A damper member is provided to couple the shaver head on top of the grip housing so as to singly and movably support the shaver head with respect to the grip housing. The weight is operatively connected to a motor and driven thereby to impart oscillatory movement to the shaver head so that the shaver head and the razor blade element can oscillate together with respect to the grip housing. The characterizing feature of the razor resides in that the motor is accommodated within the shaver head together with the weight in order to isolate an oscillatory system substantially from the grip housing through the damper member such that the shaver head can oscillate substantially independently of the grip housing, whereby minimizing counter-vibration transmitted back to the grip housing from the shaver head.

Accordingly, it is a primary object of the present invention to provide an improved oscillating razor which is capable of confining the oscillatory system within the shaver head to minimize counter-vibration transmitted back to the grip housing from shaver head, thereby greatly reducing the counter-vibration which the user feel during the shaving and consequently assuring a comfortable shaving with the grip housing held by one hand of the user.

In a preferred embodiment, the damper member is configured to exhibit less elastic modulus in the lengthwise direction of the razor blade element than in the edgewise direction thereof, or a direction perpendicular to the lengthwise direction. In other words, the damper member has greater dampening effect for the oscillation occurring in the lengthwise direction of the razor blade element than in the edgewise direction thereof. With this result, the damper member can well absorb the counter-vibration occurring in the lengthwise direction and transmitted back to the grip housing, while it can make the most of less flexible characteristic in the edgewise direction so as to positively support the shaver head and at the same time to allow the shaver head to oscillate in the edgewise direction for assuring effective shaving. This is particularly advantageous when considering a manner in which the user hold the razor during the shaving. That is, most of the user will hold the grip housing at its opposite sides along the lengthwise direction of the razor blade element by his fingers, i.e., thumb, index and middle fingers, and accordingly will be most sensitive to the counter-vibration occurring in the lengthwise direction. Consequently, by reducing the counter-vibration in that direction, the user will experience only minimum vibration at the fingers of the hand holding the grip housing and can enjoy very comfortable shave substantially free from the counter-vibration.

It is therefore another object of the present invention to provide an improved oscillating razor in which the shaver head is supported to the grip handle by means of the damper member exhibiting direction-dependent elasticity in order to minimize the counter-vibration being felt by the user for comfortable shaving, yet assuring effective shaving with the help of the forced oscillation of the shaver head occurring in the edgewise direction.

In one embodiment, the damper member is provided in the form of a hollow cylinder having upper and lower ends connected respectively to the shaver head

and the grip housing and having a neck portion intermediate the ends which is exposed between the shaver head and the grip housing to be responsible for movable support of the shaver head. To obtain the above direction-dependent elasticity, the neck portion is substantially uniform in thickness and configured to have a less inside diameter along the lengthwise direction of the razor blade element than along the edgewise direction thereof.

In another embodiment, the damper member is likewise configured into a like hollow cylinder with a like neck portion of substantially uniform thickness. The neck portion is configured to have an outside diameter which is smaller along the lengthwise direction of the razor blade than along the edgewise direction of the razor blade to obtain a desired direction-dependent elasticity.

The damper member is preferably configured to have an integral annular outer flange at the neck portion which restricts elastic deformation range of the damper member itself in order to avoid excessive deformation of the shaver head substantially in all directions with respect to the grip housing. With the provision of the annular flange, the damper member can be protected from excess deformation which may result from a large deformative force applied to the shaver head and eventually break or damage the damper member.

It is therefore a further object of the present invention to provide an improved razor which is capable of protecting the damper member from excessive deformation to thereby keep stably supporting the shaver head for assuring a long-life use or shaving.

These and still other objects and advantageous features of the present invention will become more apparent from the following description of the preferred embodiments of the present invention when taken in conjunction with the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front view of an oscillating razor in accordance with a first embodiment of the present invention;

FIG. 2 is a side view of the oscillating razor;

FIG. 3 is a front vertical sectional view of a portion of the razor;

FIG. 4 is a side vertical sectional view of the razor;

FIG. 5 is a front view of an oscillating razor in accordance with a second embodiment of the present invention;

FIGS. 6 to 8 are respectively side, rear, and bottom views of the razor;

FIG. 9 is a side view, partly in section, of the razor;

FIG. 10 is a rear view, partly in section, of the razor;

FIG. 11 is a perspective view of a damper member utilized to support a shaver head to a grip housing of the razor;

FIG. 12 is a perspective view of a clamp ring utilized to secure the upper end of the damper member to the shaver head;

FIG. 13 is a perspective view of a clasp cover utilized to secure the lower end of the damper member to the grip housing;

FIG. 14 is a sectional view taken along line 14—14 of FIG. 10;

FIG. 15 is a sectional view taken along line 15—15 of FIG. 10;

FIG. 16 is a sectional view taken along line 16—16 of FIG. 10;

FIG. 17 is a terminal block carrying terminals for electrical interconnection between batteries in the grip housing and a motor in the shaver head;

FIG. 18 is a side sectional view of the upper portion of a modified razor of the second embodiment; and

FIG. 19 is a rear view, partially in section, of the upper portion of the modified razor.

DETAILED DESCRIPTION OF THE EMBODIMENTS

First Embodiment <FIGS. 1 to 4>

Referring now to FIGS. 1 and 2, there is shown an oscillating razor in accordance with a first embodiment of the present invention. The oscillating razor comprises a grip housing 10 and a shaver head 30 carrying a standard blade cartridqe 40 of widely available configuration having single or twin blade element (not seen in the figure). The grip housing 10 is of generally cylindrical configuration adapted in use to be gripped by the fingers of a user and comprises a base barrel 11 and a cylindrical battery holder 12. The shaver head 30 is of generally cylindrical configuration with an integral nose 31 extending upwardly and forwardly at an angle of about 45° with respect to a vertical axis of the shaver head 30. Formed at the end of the nose 31 is a mount socket 32 for detachably mounting the blade cartridge 40 in such a manner that the blade element extends horizontally in a perpendicular relation to a vertical axis of the shaver head 30. The shaver head 30 is supported to the top of the grip housing lo by means of a damper member 70 so that it is movable with respect to the grip housing lo within a limited range, and is normally held in an upright position where the vertical axis of the shaver head 30 is substantially aligned with a vertical axis of the grip housing 10.

Mounted within the shaver head 30 is an electric rotary motor 50 having an output shaft 51 extending vertically upwardly to carry an eccentric weight 52. The motor 50 is held in position between an internal shoulder 33 of the shaver head 30 and a ring 34 fitted in the lower end of the shaver head 30. The motor 50 is powered by a pair of batteries 60 held in tandem arrangement within the battery holder 12 to rotate the eccentric weight $z for imparting an oscillatory movement to the shaver head 30 and consequently the blade element with respect to the grip housing 10. Preferably, it is desired to generate the oscillation at 10,000 to 30,000 strokes per minute [spm]with an amplitude of 0.15 mm to 0.30 mm. Such oscillation is determined by suitably selecting the rotational speed of the motor 50, eccentricity and mass of the weight 52. A vertically slidable switch handle 14 is mounted on the base barrel 11 to actuate an actuator 15 in the base barrel 11 for electrical connection and disconnection of the motor 50 to and from the batteries 60. Mounted within the base barrel 11 is a terminal block 20 carrying a set of switch contacts connected to the batteries 60 through terminal 22, and lead wires 23 extending through the damper member 70 into the shaver head 30 for electrical connection with the motor 50. The upper end of the battery holder 12 is threaded into the bottom opening of the base barrel 11 with a seal ring 16 fitted therebetween for water-tight sealing.

The damper member 70 is made of rubber or elastomer into a hollow cylinder having upper and lower ends 71 and 72 respectively secured to the lower end of the shaver head 30 and the upper end of the base barrel 11.

The damper member 70 is formed at a portion intermediate between the ends 71 and 72 With a reduced-in-diameter neck portion 74 which is exposed between the shaver head 30 and the grip housing 10. It is this neck portion 74 that exhibits elasticity for movably supporting the shaver head 30 onto the grip housing 10 and allowing the shaver head 30 to move substantially in all direction with respect to the grip housing 10. The neck portion 74 is formed to have substantially the same thickness around its periphery and is specially designed into a somewhat ellipse configuration having a less internal diameter along the lengthwise direction of the blade element than in a direction perpendicular thereto, i.e., the edgewise direction of the blade element, as shown in FIGS. 3 and 4, such that the damper member 70 exhibits at the neck portion 74 a less elastic modulus in the lengthwise direction of the blade element (i.e., in the plane of FIG. 3) than in the edgewise direction (i.e., in the plane of FIG. 4). Whereby, the damper member 70 is enabled to absorb the counter-vibration which is transmitted back from the oscillatinq shaver head 30 to the grip housing 10 and occurs in the lengthwise direction of the blade element by a greater extent than that occurring in the edgewise direction.

It should be noted at this time that, due to the requirement of positively supporting the shaver head 30 to the grip housing 10, the damper member 70 as a whole must have a rather stiff characteristic or reduced elasticity yet retaining sufficient elasticity allowing the blade element and the shaver head to oscillate for effective shaving, although it is required to minimize the counter-vibration which the user feels during the shaving. To satisfy the above requirements, it is firstly considered that the shaver head and the blade element is preferred to oscillate in the edgewise direction of the blade element rather than in the lengthwise direction in order to obtain effective or close shave. Secondly, an analysis is made as to a manner in which the user will manipulate the razor during the shaving in order to evaluate which oscillation is most sensitive to the user, i.e., which oscillation is seriously felt by the user. The analysis reveals that most of the users will hold the opposite sides of the grip housing along the lengthwise direction of the blade element between the thumb and index finger and middle finger. Consequently, it is found that reducing the counter-vibration in the lengthwise direction will effectively and greatly minimize the counter-vibration which the user feels during the shaving. Therefore, it is possible to satisfy the above two requirements by configuring the damper member 70 to exhibit less elastic modulus in the lengthwise direction of the blade element than in the edgewise direction such that the counter-vibration in the lengthwise direction can be well absorbed in the damper member 70 to minimize the counter-vibration which the user feels at the grip housing 10, while the damper member 70 exhibits rather greater elastic modulus in the edgewise direction so as to positively support the shaver head 30 and to allow the shaver head 30 to oscillate in the edgewise direction for effective shaving.

Although the reduced elastic modulus of the damper member 70 in the lengthwise direction may appear to enhance the oscillation of the shaver head 30 and therefore the blade element in that direction, the oscillation of the blade element in that direction will not be so enhanced as to prevent excess oscillation leading to injure the skin because of the elongated and symmetrical configuration of the blade cartridge about the vertical axis of the shaver head 30 makes it more reluctant to oscillate in the lengthwise direction than in the direction perpendicular thereto along which the blade cartridge is asymmetrical about the vertical axis of the shaver head 30. Consequently, the blade element can oscillate generally in the edgewise direction thereof so as to assure effective shaving, yet maintaining the lengthwise oscillation within an acceptable level. In view of the above, the damper member 70 is preferably designed to exhibit an elastic modulus of 20–30 g/m in the lengthwise direction and that of 40–50 g/m in the edgewise direction. Although the damper member 70 is preferred to have the differing direction-dependent elasticity by the reason discussed in the above, the present invention should not be understood to be limited thereto and may use a damper member having a substantially uniform elasticity in those directions since the damper member serves to singly support the shaver head and therefore can absorb the counter-vibration in the lengthwise and the edgewise directions. Further, in the above embodiment, the damper member is made to exhibit the differing elastic modulus by differentiating the inside diameters along the different directions rather than the thickness thereof to retain the feasibility of fabricating the damper member, it is of course possible to give such differing elasticity by other designs.

The damper member 70 is additionally formed with an outside annular flange 75 extending around the entire circumference thereof at a vertically middle of the neck portion 74 in order to prevent an excessive deformation of the damper member 70, or prevent it from buckling when the shaver head 30 receives an unusual external deformative force other than the oscillatory force. Therefore, the damper member 70 can be well protected being damaged or collapsed even when the razor is accidentally dropped to the floor, thus stably supporting the shaver head 30 on the grip housing 10.

It is noted at this time that since the damper member 70 of rubber or elastomer has its upper and lower ends connected directly respectively to the grip housing 10 and the shaver head 30, these ends can be best utilized to effect the water-tight seal between the shaver head 30 and the grip housing 10.

Second Embodiment <FIGS. 5 to 17>

FIGS. 5 to 7 illustrate an oscillating razor in accordance with the second embodiment of the present invention which is basically similar to the first embodiment and comprises a grip housing 110 and a shaver head 130 movably supported to the grip housing 110 by means of a damper member 170. The shaver head 130 is of generally hollow cylindrical configuration and is formed at its upper end with an integral nose 131 which extends upwardly and forwardly at an angle of about 45° with respect to a vertical axis of the shaver head 130. The nose 131 terminates in a mount socket 132 for detachably receiving a like blade cartridge 140 of commercially available type having a single or twin blade element 141. As shown in FIG. 9, an electric motor 150 is received within the shaver head 130 with its output shaft 151 extending upwardly in coincidence with the vertical axis of the shaver head 130. The motor 150 is fixed in position with its upper end engaged against an internal shoulder 133 at the upper end portion of the shaver head 130 and with its lower end seated upon the upper inserted end of the damper member 170 The output shaft 151 carries an eccentric weight 152 which is driven to rotates for imparting a like oscillatory movement to the shaver head 130 as in the first embodi-

ment such that the shaver head 130 can oscillate with respect to the grip housing 110.

The grip housing 110 comprises a base barrel 111 and a battery holder 112 which are both of generally hollow cylindrical configuration and are connected axially to one another. The battery holder 112 is threadedly engaged at its upper end with the lower end of the base barrel 111 and accommodates therein a pair of batteries 160 which are electrically connected to the motor 150 through an actuator 115. The base barrel 111 has a vertically slidable switch handle 114 Which actuates the actuator 115 for energizing and deenergizing the motor 150. A clasp cover 190 is fitted over the base barrel 111 for connection of the base barrel 111 Or the grip housing 110 to the damper member 170.

As best shown in FIG. 11, the damper member 170 is shaped from a rubber or elastomer into a generally hollow cylindrical configuration with upper, middle, and lower annular flanges 171, 175, and 178 respectively extending outwardly and spaced Vertically with each other. The upper flange 171 defines upwardly thereof a tube end 172 which is inserted in the lower opening of the shaver head 130, as shown in FIGS. 9 and 10, and is secured thereto by means of a clamp ring 180 fitted around the lower end portion of the shaver head 130. As shown in FIG. 12, the clamp ring 180 is formed at its upper end with a set of circumferentially spaced and inwardly projecting bayonet lugs 181 and at its lower end With an inward rim 182 with a set of circumferentially spaced slots 183. The bayonet lugs 181 engage into correspondingly formed notches 136 in the lower end of the shaver head 130 with the upper flange 171 of the damper member 170 clamped between the inward rim 182 and the lower end of the shaver head 130 so that the shaver head 130 is coupled to the upper end of the damper member 170. The upper flange 171 includes a set of downwardly projecting catch 173 which are received in Ones of the slots 183 of the rim 182, as seen in FIG. 9, for unrotatively fixing the shaver head 130 to the damper member 170. A seal ring 137 is fitted between the upper flange 171 and the lower end of the shaver head 130 for water-tight sealing therebetween. Also, a metal ring 138 is fitted within the upper tube end 172 to press it against the lower end of the shaver head 130.

For connection with the grip housing 110, the lower portion of the damper member 170 including the middle flange 175 is inserted in the top opening of the base barrel 111 and is secured thereto by means of the clasp cover 190 in such a manner to define between the upper and middle flanges 171 and 175 a neck portion 174 which is exposed between the shaver head 130 and the grip housing 110 and responsible for movably supporting the shaver head 130 to the grip housing 110. As shown in FIG. 13, the clasp cover 190 is of generally C-shaped configuration having a pair of inwardly extending tongues 191 at its upper end, a set of side projections 192, and a center projection 193. As best shown in FIG. 10, the clasp cover 90 is fitted around the base barrel 111 with the tongues 191 inserted through the side wall of the base barrel 111 into a groove 176 between the middle and lower flanges 175 and 178 of the damper member 170, while the side and center projections 192 and 193 are press-fitted into corresponding notches (not seen) in the base barrel 111. At this condition, the damper member 170 is unrotatively fixed to the base barrel 111 by engagement of a boss 177 projecting outwardly from the groove 176 into a corresponding notch 118 in the upper opening of the base barrel 111. A seal ring 116 is fitted around an end groove 179 below the lower flange 178 and is pressed against the inside wall of the base barrel 111 to effect a water-tight sealing thereat. A metal ring 119 is fitted within the lower end portion of the damper member 170 to back up the same for secure coupling of the damper member 170 to the base barrel 111.

To minimize the count-vibration which the user feels during the shaving and at the same time to stably but movably support the shaver head 130 On the grip housing 110 for assuring the oscillation of the blade element in the edgewise direction thereof, the neck portion 174 of the damper member 170 is specially designed, as shown in FIG. 16, to have a generally ellipse configuration having a less outside diameter D: in the lengthwise direction than that Dz in the edgewise direction of the blade element while keeping the thickness of the neck portion 174 substantially uniformly therearound. With this arrangement, the neck portion 174 exhibit less elastic modulus in the lengthwise direction than in the edgewise direction of the blade element or the blade cartridge 140, thereby assuring the above requirements just in the same reason as described in the first embodiment. In this connection, the damper member 170 is designed to have like elastic modulus in the respective directions as in the first embodiment.

Received within the base barrel 111 below the damper member 170 is a terminal block 121 which, as shown in FIG. 17, carries a set of switch contacts 121; terminals 122 for connection with the batteries 160, and lead wires 123 extending upwardly through the damper member 170 into the shaver head 130 for connection with the motor 150. One of the switch contacts 121 is operatively connected through an actuator 115 to the switch handle 114 so that it connects and disconnects the motor 150 to and from the batteries 160 upon sliding movement of the switch handle 114. The terminal block 120 also includes a pair of upstanding posts 126 with hooks 127 at the upper ends and is held in position by engaging the hooks 127 respectively with an inner shoulder 172A formed at the damper member 170 interiorly of the middle flange 175 over the metal ring 119, as shown in FIGS. 9 and 10.

A modification of the second embodiment is shown in FIGS. 18 and 19 which is identical in structure to the second embodiment except for a coil spring 200 interposed between the motor 150 and the damper member 170. The upper end of the coil spring 200 is fitted over a center post 155 on the lower end of the motor 150, While the lower end of the coil spring 200 rests upon the inner shoulder 172A of the damper member 170. Thus, the coil spring 200 extends within the damper member 170 past the neck portion 174 upwardly to the motor 150 fixed to the shaver head 130 so that it can reinforce the damper member 170 against excess bend, torsion, and tension forces.

Although the above embodiments disclose the use of the electric rotary motor in combination with the eccentric weight for imparting the oscillatory movement to the shaver head, the present invention should not be understood to be limited thereto and may use other motors including those of solenoid type having an oscillating plunger or the like for generating desired oscillation to the shaver head.

What is claimed is:

1. In a motor-driven oscillating razor comprising:
a grip housing adapted to be gripped by a user;

a shaver head carrying a razor blade element, said shaver head incorporating an oscillation inducing weight;

a damper member singly supporting said shaver head on the top of said grip housing in such a manner that said shaver head is allowed to move with respect to said grip housing;

a motor operatively connected to oscillate said weight for imparting oscillatory movement to said shaver head; and

said razor being characterized in that said motor is accommodated within said shaver head in order to isolate an oscillatory system substantially from said grip housing by said damper member such that said shaver head can oscillate substantially independently of said grip housing.

2. A motor-driven oscillating razor as set forth in claim 1, wherein said damper member exhibiting less elastic modulus in the lengthwise direction of said razor blade element than in an edgewise direction thereof.

3. A motor-driven oscillating razor as set forth in claim 2, wherein said damper member is in the form of a hollow cylinder having upper and lower ends secured respectively to said shaver head and said grip housing, said cylinder having a neck portion intermediate said ends which is exposed between said shaver head and said grip housing and responsible for movable support of said shaver head, said neck portion being substantially uniform in thickness and configured to have a less inside diameter along the lengthwise direction of said razor blade element than along the edgewise direction thereof.

4. A motor-driven oscillating razor as set forth in claim 1, wherein said damper member is made of rubber or elastomer to effect water-tight sealing at connections to said shaver head and said grip housing.

5. A motor-driven oscillating razor as set forth in claim 1, wherein said damper member is in the form of a hollow cylinder having upper and lower ends secured respectively to said shaver head and said grip housing, said cylinder having a neck portion intermediate said ends which is exposed between said shaver head and said grip housing and responsible for movable support of said shaver head, said neck portion having an annular flange which restricts an elastic deformation of the damper member.

6. A motor-driven oscillating razor as set forth in claim 1, wherein said motor has an output rotating shaft projecting upwardly in the direction away from said damper member for mounting said weight eccentrically.

7. A motor-driven oscillating razor as set forth in claim 1, wherein said grip housing is provided with a switch handle for energizing and deenergizing said motor.

8. A motor-driven oscillating razor as set forth in claim 1, wherein said damper member is in the form of a hollow cylinder in which a coil spring is held with its upper end connected to said motor and with its lower end supported within said damper member for reinforcing the damper member.

9. A motor-driven oscillating razor as set forth in claim 1, wherein said damper member is in the form of a hollow cylinder having upper and lower ends secured respectively to said shaver head and said grip housing, said cylinder having a neck portion intermediate said ends which is exposed between said shaver head and said grip housing and responsible for movable support of said shaver head, said neck portion being substantially uniform in thickness and configured to have a less outside diameter along the lengthwise direction of said razor blade element than along the edgewise direction thereof.

10. A motor-driven oscillating razor as set forth in claim 1, wherein said damper member is in the form of a hollow cylinder having upper and lower ends secured respectively to said shaver head and said grip housing, said cylinder having a reduced-in-diameter neck portion intermediate said ends which is exposed between said shaver head and said grip housing and responsible for movable support of said shaver head, said upper and lower ends of the damper members inserted respectively in said shaver head and said grip housing and clamped thereat by the use of metal rings which are fitted respectively within said upper and lower ends to press said ends against the corresponding walls of said shaver head and said grip housing.

* * * * *